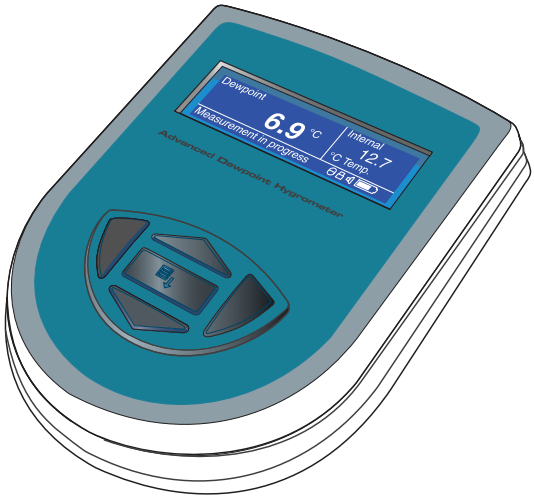
HygroPort I.S. Hygrometer
User's Manual



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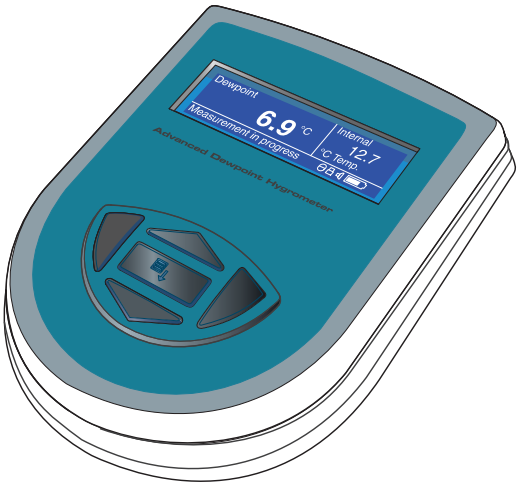


HygroPort I.S. - Advanced Dewpoint Hygrometer
(for use in hazardous areas)

Contents

Safety v
Electrical Safety v
Pressure Safety v
Toxic Materials v
Repair and Maintenance v
Calibration v
FCC Declaration vi
Abbreviations vii
Warnings viii
Calibration ix

1 INTRODUCTION 1

2 DESCRIPTION 3
2.1 Controls and Indicators 4
2.2 Function Keys 5
2.3 Instrument Display 7
2.4 Instrument Start-Up 8
2.4.1 Display Units 10
2.5 Main Menu 10
2.6 Overall Menu Structure 12
2.6.1 General Settings 14
2.6.2 Logging 15
2.6.3 Bluetooth Settings 16
2.6.4 External Sensor Interface 17
2.6.5 Real Time Clock Settings 18
2.6.6 HMI Settings 19
2.6.7 Calibration 20
2.6.8 Info 20
2.6.9 Chart Options 21

3 SET UP 23
3.1 Safety 23
3.2 Unpacking the Instrument 23
3.3 HygroPort I.S. Accessories 24
3.4 Operational Requirements 26
3.4.1 Environmental Requirements – HygroPort I.S. Instrument 26
3.4.2 Charger Electrical Requirements 26
3.5 Instrument Gas Connections 26
3.5.1 Gas Inlet /Outlet Fittings 27

3.6 Connect External Transmitters 28
3.6.1 Set up External Sensor Interface 29
3.6.2 Entering User Pressure 30
3.7 Connect Battery Charger 30

4 OPERATION 32
4.1 Preparation for Operation 32
4.2 General Operational Information 32
4.3 Operation Guide 35
4.4 Graphics Display 37
4.4.1 Display Datalog File List 37
4.4.2 Display Current Datalog File 38
4.5 Logging 38
4.6 Bluetooth Mode 39
4.6.1 Bluetooth Pairing Procedure 39
4.7 Interchange Primary and Secondary Displays (HMI) 41

5 APPLICATION SOFTWARE 42

6 GOOD MEASUREMENT PRACTICE 43
6.1 General Operational Guidelines 44

7 CALIBRATION 46
7.1 Traceability 46
7.2 Calibration Method 47
7.3 Calibration Correction Method 48

8 PREPARATION FOR SHIPPING 50

Figures

Figure 1.1 HygroPort I.S. Advanced Dewpoint Hygrometer 2

Figure 2.1 User connections, controls and indicators 3
Figure 2.2 Function keys 5
Figure 2.3 Instrument display 7
Figure 2.4 Instrument start-up sequence 9
Figure 2.5 Change display units 10
Figure 2.6 Passcode entry 11
Figure 2.7 HygroPort I.S. menu structure 13
Figure 2.8 General Settings menu 14
Figure 2.9 Set-up Logging menu 15
Figure 2.10 Bluetooth settings 16
Figure 2.11 External transmitter 17
Figure 2.12 Real time clock settings 18
Figure 2.13 HMI settings 19
Figure 2.14 Calibration 20
Figure 2.15 Info screen 20
Figure 2.16 Typical chart plot 21
Figure 2.17 Re-set chart 21
Figure 2.18 Datalog file list 21
Figure 2.19 Current log file 22

Figure 3.1 Packing method 23
Figure 3.2 Gas port adaptors 24
Figure 3.3 Accessories 25
Figure 3.4 Gas coupling examples for atmospheric pressure measurement 27
Figure 3.5 HygroPort I.S. Remote Sensor Interface 28
Figure 3.6 External transmitter connection 28
Figure 3.7 Typical external dewpoint display 29
Figure 3.8 Connect battery charger 30

Figure 4.1 HygroPort I.S. menu structure 34
Figure 4.2 Initialization mode 36
Figure 4.3 Typical chart display 37
Figure 4.4 Datalog file list 37
Figure 4.5 Typical log file display 38
Figure 4.6 Logging set-up menu 38
Figure 4.7 Bluetooth set-up menu 39
Figure 4.8 Typical Bluetooth pairing sequence 40
Figure 4.9 HMI set-up menu 41
Figure 4.10 Typical 'external as primary' display screen 41

Figure 5.1 Typical application software screen 42

Figure 7.1 Typical 7-point calibration certificate 46
Figure 7.2 HygroPort I.S. calibration correction screen 48
Figure 7.3 Edit HygroPort I.S. look-up table 49

Figure 8.1 Instrument packing details....50

Figure C.1 Current datalog file display....67
Figure C.2 HygroPort I.S. status register....67
Figure C.3 HygroPort I.S. status register (Hex 28)....67

Tables

Table 2.1 Controls and indicators....4
Table 2.2 Instrument display descriptions....7
Table 2.3 General Settings....14
Table 2.4 Logging parameter set up....15
Table 2.5 Bluetooth settings....16
Table 2.6 External transmitter selection....17
Table 2.7 Real time clock settings....18
Table 2.8 HMI settings....19

Table 3.1 Adaptor fittings....26

Table 4.1 HygroPort I.S. default parameters....33

Table 7.1 Example of calibration run readings....47

Table C.1 Status register flags....68

Appendices

Appendix A Technical Specifications....51

Appendix B Hazardous Area Certification....54
A.1 Baseefa Certificate....56
A.2 ICEx Certificate of Conformity....58
A.3 FM Approvals Certificate of Compliance....62
A.4 CSA Certificate of Compliance....64

Appendix C Datalog Status Display....66

Appendix D EC Declaration of Conformity....69

Safety

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated. Do not apply values greater than the maximum values stated.

This manual contains operating and safety instructions, which must be followed to insure the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage. Competent personnel using good engineering practice must follow all procedures in this manual.

Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument. The instrument is powered by an internally mounted rechargeable battery. This battery should never be allowed to fully discharge. The input power supply voltage limits for the battery charger supplied with the instrument are 100 V AC to 240 V AC, 47 to 63Hz. Refer to Appendix A.

NOTE: No other battery charger unit, other than that supplied with the instrument should be used.

NOTE: Do not allow the battery to fully discharge.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specifed safe working pressure (SWP), for this instrument is 5000 psi (350 bar). Refer to Appendix A - Technical Specifications.

Toxic Materials

The use of hazardous materials in the construction of this instrument has been minimized. During normal operation it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. Care should, however, be exercised during maintenance and the disposal of certain parts.

Repair and Maintenance

The instrument must be maintained by Kahn Instruments, Inc.

Kahn Instruments, Inc.
885 Wells Rd.
Wethersfield, CT 06109
Phone: 860-529-8643 Fax: 860-529-1895
E-mail: info@kahn.com

Calibration

The recommended calibration interval for this instrument is 12 months. The instrument should be returned to Kahn Instruments, Inc. for re-calibration.

FCC Declaration

HygroPort I.S. Advanced Dewpoint Hygrometer.

This Device complies with FCC Rules Part 15 Subpart B Unintentional Radiators
Class B digital devices. Operation is subject to the following conditions:

1) This device may not cause harmful interference
2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This product has been tested and found to comply with the limits or Class B digital devices, pursuant to Part 15 of the FCC rules. This product generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not in a particular installation. If this product does cause harmful interference to radio reception, which may be determined by turning the product on & off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna,
- Increase the separation between the product and receiver,
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

This product must be operated as per the operating instructions provided.
Do not make any alterations or modifications to the product. Any unauthorised alterations or modifications made to this product may require you to stop operating the product.

Canadian Radio Interference Regulations.
This Class B digital product complies with Canadian ICES-003, CISPR 22 :1997.
Règlement canadien sur les interférences radio.
Ce produit numérique de classe B est conforme à la norme NMB-003, CISPR 22: 1997.

Signed for, and on behalf of,
Kahn Instruments Ltd.

Andrew M.V. Stokes, Technical Director

Issue date: 05/2011

Abbreviations

The following abbreviations are used in this manual:

AC	alternating current
atm	pressure unit (atmosphere)
bar	pressure unit (=100 kP or 0.987 atm)
Bar a	bar absolute
Bar g	bar gauge
°C	degrees Celsius
°F	degrees Fahrenheit
K	Kelvin (absolute temperature)
COM	common
contd	continued
DC	direct current
ENT	enter (select)
ft	foot (feet)
Hz	Hertz
in	inch(es)
in^2	square inch(es)
N/C	not connected (no connection)
kg	kilogram(s)
kΩ	kilohm(s)
lb	pound
LSD	least significant digit
m	meter(s)
mA	milli Ampere
max	maximum
min	minute(s)
mm	millimeter(s)
MPa	megapascal (Pascals x106)
mV	milli Volt(s)
No.	number
PIN	personal identification number
ppmv	parts per million (by volume)
rdg	reading
%rdg	percentage of reading
RS232	serial data transmission standard
Rx	receive
SWP	safe working pressure
sec	second(s)
temp	temperature
Tx	transmit
V	volts
Ω	Ohms

Warnings

The following general warning listed below is applicable to this instrument. It is repeated in the text in the appropriate locations.

Where this hazard warning symbol appears in the following sections it is used to indicate areas where potentially hazardous operations need to be carried out.

Calibration

Dewpoint calibrations are traceable to the National Institute of Standards & Technology (NIST) in the United States over the range -103 to +68°F (-75 to +20°C) and to the National Physical Laboratories (NPL), in the United Kingdom, over the range of -130 to +194 °F (-90 to +90 °C).

1 INTRODUCTION

The HygroPort I.S. Advanced Dewpoint Hygrometer is a portable instrument designed for the on-line measurement of moisture content in non-corrosive gases in hazardous areas, over an operational range of -148 to +68°F (-100 to +20°C).

The instrument is independently assessed and certificated as being intrinsically safe and fully compatible with safe operation for Class I, Division 1, Groups A, B, C, D.

The instrument is contained within a rugged case, sealed to NEMA4 (IP66) standard and is powered by an internally mounted Nickel Metal Hydride (NiMH) battery designed to typically provide 24 hours continuous use between charges. Continuous battery charge status indication is provided. Additional battery status information is provided by a "battery low" warning beep and indicator. The HygroPort I.S. is equipped with an internally mounted ceramic sensor, which is enhanced for a quicker response to dewpoints as dry as -103°F (-75°C) dewpoint.

The HygroPort I.S. can also be used to read the dewpoint signal from a Kahn Instruments' Easidew I.S. Transmitter. To do this, the HygroPort I.S. Remote Sensor Interface is used to connect to the Easidew I.S. Transmitter.

No other sensor can be connected to the HygroPort I.S.

A graphical display presents the dewpoint data in large format characters and simultaneously provides a primary display of real time dewpoint readings and a secondary display, in smaller characters, for the external transmitter input. If no external input is programmed, gas temperature, measured by the internal sensor, is displayed by default.

A fully programmable, real-time, datalogging facility is provided which has an internal memory capacity of 8Mb, capable of storing up to 10,000 logs per file (typically giving a maximum of 32 log files).

A Bluetooth, wireless communication system is provided, giving access to a dedicated, PC-based HygroPort I.S. Software Application Package which provides the facility for handling the logged data files and uploading and downloading instrument parameters.

A user-friendly operator interface provides easy access to all levels of the instrument's functionality.

An easy to follow calibration routine is built into the instrument's software. The calibration routines are described in Section 7.

Two versions of the instrument are available, a HygroPort (standard) version and HygroPort I.S. (intrinsically safe) version.

This manual covers the HygroPort I.S. version only. *Figure 1.1* shows the instrument.

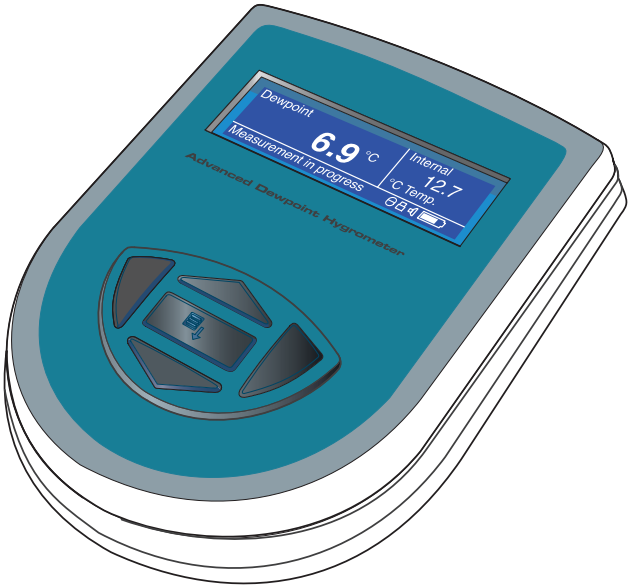


Figure 1.1 *HygroPort I.S. Advanced Dewpoint Hygrometer (for use in hazardous areas)*

2 DESCRIPTION

The controls and indicators associated with the HygroPort I.S. instrument are located on the front panel of the instrument.

Connections to the HygroPort I.S. dewpoint hygrometer, comprising the gas ports, battery charger input connector and input connector for the external transmitter, are all made to the top panel.

Figure 2.1 shows the layout of these controls and Table 2.1 describes their respective operational functions.

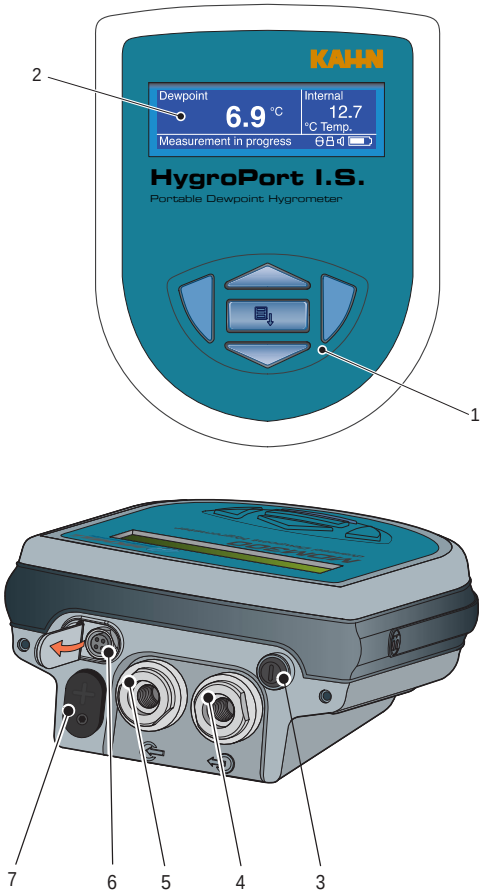


Figure 2.1 *User connections, controls and indicators*

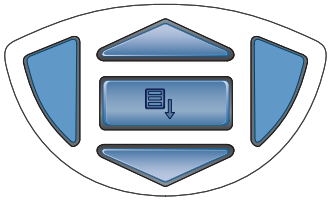
2.1 Controls and Indicators

Item	Panel	Description
1	Front	Function keys. Refer to Table 2.2 for the details of these keys.
2	Front	Instrument display. Partitioned to show 3 main panels, a primary display showing internal sensor parameters, a secondary display indicating the external transmitter parameter, and a status display area. The status display area shows icons representing battery charge state, initialization in progress, data logging in progress, keyboard lock status and keyboard beep status.
3	Top	Instrument ON/OFF switch. **NOTE: The instrument does not need be switched ON in order to charge the internal NiMH battery.**
4	Top	Gas output port. Refer to Section 3.5
5	Top	Gas input port. Refer to Section 3.5
6	Top	Analog input connector for external transmitter. By default, this signal is displayed in the secondary display area but may be configured to be displayed as the primary display (refer to Section 2.6.6). If no external input is selected, the internal sensor temperature is displayed by default, (refer to Section 2.6.6). The hinged rubber protection cover should be kept closed when the connector is not in use.
7	Top	Socket for connection of battery charger *(located behind secured cover similar to external transmitter socket cover above).* ⚠ ***Connection to the battery charger should always be made in a safe area - never in a hazardous area environment .*** The secured cover should be kept screwed on when the connector is not in use. ⚠ **ONLY USE THE CHARGER PROVIDED** ⚠ **Never allow the battery to fully discharge**

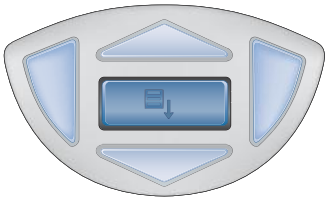
Table 2.1 Controls and indicators

2.2 Function Keys

The function keys, located below the display, are used to select operations from the Main Menu level (selected by the center key), to enter sub-menu levels and to select and enter parameter variables within those menu levels.



The function key panel is shown (right) and the operation of the keys is as follows:



Enter key. Operation of this key from the front page display causes the Passcode Display Screen for entry to the Set-up menus to be displayed.

The Passcode PIN must then be entered, using a combination of the ▲ (up) and ▼ (down) keys located above and below. After each digit is selected, this Enter key should be pressed in order to accept the entered digit. Within the Settings menu and sub-menus, this key is used to highlight and select options and to accept entered values.

Scroll down key. From the Passcode entry page, this key is used to reduce the value of the highlighted passcode entry digit.

Within the Set-Up Menu this key is used to highlight one of the Settings sub-menu options for entry to that level which is then entered by pressing the Enter key.

Within sub-menus this key is used to scroll down and highlight options available for selection within that sub-menu.

Within sub-menu levels requiring the entry of alpha numeric values e.g. for the entry of datalog parameters, this key is used to decrease the currently displayed value i.e. (Z-A, 9-0). Pressing the key once decreases the selected field by one step. Pressing and holding the key will cause the selected field to be continuously decreased until the key is released.

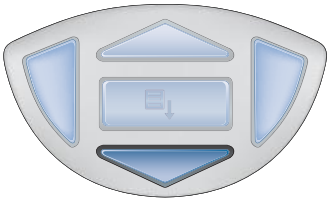


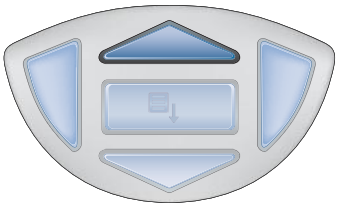
Figure 2.2 *Function keys*

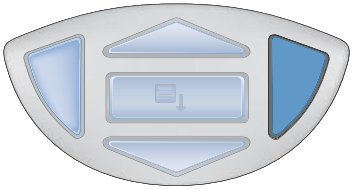
Scroll up key. From the Passcode entry page, this key is used to increase the value of the highlighted passcode entry digit.

Within the Settings menu this key is used to scroll up through the menu options to select (highlight) a required option. The required sub-menu for that option can then be entered by pressing the Enter key.

Within sub-menus this key is used to scroll up and highlight options available for selection within that sub-menu.

Within sub-menu levels requiring the entry of alpha numeric values, e.g. for the entry of datalog parameters, this key is used to increase the currently displayed field value (i.e. 0-9, A-Z). Pressing the key once increases the selected field by one step. Pressing and holding the key will cause the selected field to be continuously increased until the key is released.

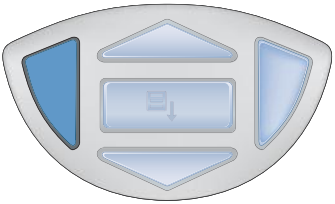




Scroll right key. Within the Logging (datalog) sub-menu levels, where the entry of alpha numeric characters is required, this key is used to shift the insertion point right in the file name entry field.

At each position, a combination of the scroll up and scroll down keys is used to select the required alpha numeric value. When the full field name has been entered, the file is created by pressing the Enter key.

Scroll left/Escape. Within any menu or sub-menu level, pressing this key escapes to the next highest menu above the current level. For example, to return to the Main Display from the Input Passcode screen press this key once. Similarly, to return to the Settings menu from any of its sub-level menus, press this key once. Within the Logging (datalog) sub-menu levels, where the entry of alpha numeric characters is required, this key is used to shift the insertion point to the left in the file name entry field. As the insertion point is shifted to the left, the entry at the former position is deleted.



2.3 Instrument Display

The graphics display and the associated function keypad (*Figure 2.1),* form the operator interface of the equipment. *Figure 2.3* shows all of the elements of a typical display screen after the instrument's Initialization period has completed.
Table 2.2 details the elements of the display

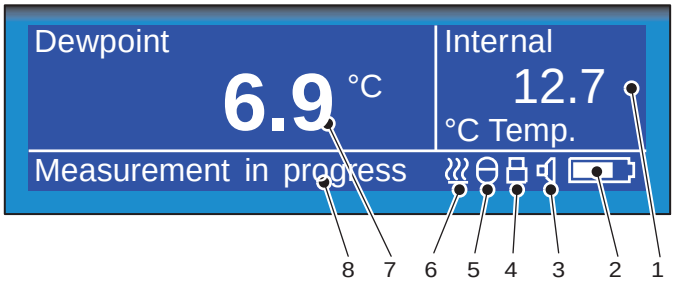


Figure 2.3 *Instrument display*

Item	Description
1	**Secondary display.** Shows reading from external transmitter, if configured: or internal temperature if external transmitter not configured. Internal reading shown in this example shows internal dewpoint if external sensor reading is set as primary display.
2	**Battery charge indicator icon.** Flashes when the battery voltage drops below 4V, indicating that the battery needs charging. A warning beep also sounds when the battery charge level is low. The icon also flashes when the charger is connected.
3	**Keyboard beep indicator.** This icon indicates that the keyboard beep is switched on. The position of the icon in the status line may vary.
4	**Keyboard lock indicator.** This icon indicates that the keyboard is locked. The position of the icon in the status line may vary.
5	**Datalog status indicator.** This icon indicates that logging is enabled and running. The position of the icon in the status line may vary.
6	**Sensor initializing indicator.** This icon indicates that the initialization Process is in progress and that sensor heating is on. The presence of this symbol is accompanied by **Initializing internal sensor** status message. The position of the icon in the status line may vary.
7	**Primary Display.** Main display (large characters).
8	**Status message display area.** Displays status and error messages.

Table 2.2 Instrument display descriptions

The instrument display is divided into three distinct areas - a primary display area, a secondary display area and a status display area (refer to Item 2 in Table 2.1). During normal operation, the internal sensor is configured as the primary (large character) display and can be configured for either internal temperature or external transmitter reading, depending upon how the instrument has been set up.

2.4 Instrument Start-Up

When turned on, the instrument goes through an initialization process of between 4 and 7 minutes, depending on the sensor and sample gas characteristics, during which time the internal sensor is heated to a maximum of 140°F (60ºC). The heating process excites the moisture molecules already present in the sensor and accelerates equilibration with the moisture content of the sample gas. During this period the sample gas flow purges the system. After this period, the sensor will be dried to below the dewpoint of the gas to be measured. The heating is then switched off and the display flashes.

Figure 2.4 shows a typical start-up sequence.

When turned on, the System Initializing screen is displayed for a period of approximately five seconds; following which the Initialization screen is displayed for a period of 1 minute. Thereafter the screen will show a countdown time of the remaining initialization time.

During this period, gas will be flowing through the sensor and can be externally regulated to meet the instrument's flow requirements. The real time sensor temperature is indicated in the secondary display area. The Initializing icon (item 6 in *Figure 2.3)* is displayed in the status area. The keyboard, with the exception of the scroll up and scroll down keys, is locked out, as indicated by the keyboard lock icon (item 4 in *Figure 2.3)*, until the initialization period has expired. Note that it is possible to terminate the initialization process before the initialization period has timed out by pressing the scroll up and scroll down keys simultaneously. This action aborts the instrument's response enhancement system but allows the operator to make an immediate measurement if the measured dewpoint is wetter than –4°F (-20ºC) dewpoint.

While the initialization process is in progress, the backlight time-out is precluded and, if any external transmitter has been configured and connected to the instrument, display of the external transmitter reading is also precluded. After the end of the initialization period, the display reverts to the measurement mode displaying the dewpoint (in the currently selected unit) in the primary display area, and any external transmitter reading in the secondary display area. By default, the internal temperature is displayed in the secondary display area if no external transmitter is configured.

If an external transmitter has been selected but has either not been connected or is giving an over-range indication, a flashing **External Sensor Error** message (alternating either with a **Measurement in progress** or a **Measurement OK** message) will be displayed. While the instrument is responding to dewpoint changes, a **Measurement in progress** message is displayed. When the reading has been acquired, and the instrument has been dynamically tracking it for a given period, a message, M**easurement OK**, indicates that the instrument is stable and reading within 0.9°F (0.5°C) for two minutes.

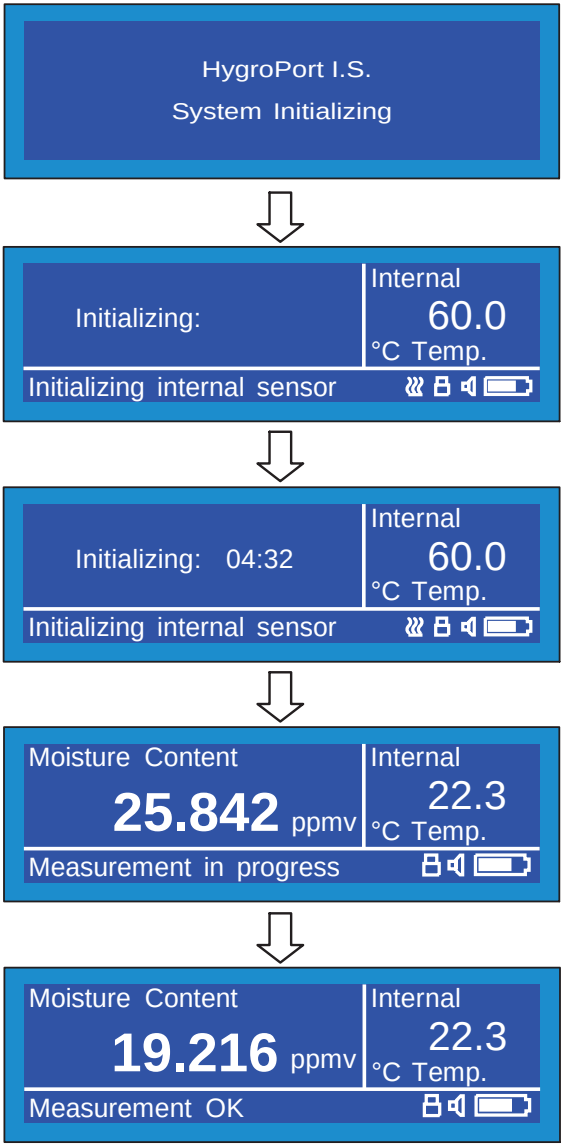


Figure 2.4 *Instrument start-up sequence*

2.4.1 Display Units

The instrument can display the measured reading in a number of different units as follows: °C, °F, K dewpoint and gas temperature; ppm_v and g/kg for air, N_2, H_2, CO_2, SF_6; ppm_v, lb/MMscf and g/m^3 for natural gas, ppm_v, g/m^3, %RH, Moisture Content (ppm_W) and (ppm_v) and Calculated Dewpoint at pressure (°C, °F or K).

To toggle between displayed units, press either the scroll up or scroll down key. *Figure 2.5* illustrates an example showing the method of changing display units from Dewpoint to Absolute Humidity.

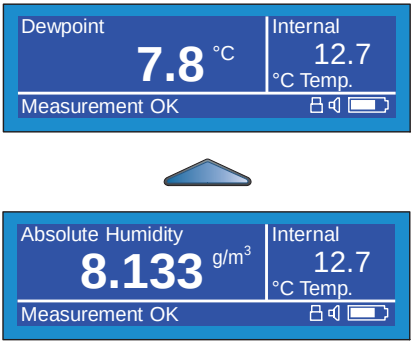


Figure 2.5 *Change display units*

2.5 Main Menu

All instrument settings are made from a top level Settings menu which is accessible from the Main Display. This menu is accessed from the Main Display by pressing the Enter key. On the first occasion after instrument is turned on the passcode entry screen is displayed. The passcode PIN, 7316, must then be entered.

NOTE: After 10 seconds of inactivity, the keyboard is locked. To unlock, press any key.

Figure 2.6 shows the entry sequence. This flowchart and all other flowchartscharts in this handbook should be read from top to bottom and left to right.
With the first digit of the passcode entry screen highlighted in reverse video, enter the first digit (7) by pressing the ▼ (down) key three times. (Pressing the ▲ (up) key seven times would have the same effect.) Press the Enter key to accept this entry and move to the next digit position.

Enter the second digit by pressing the ▲ (up) key three times, to display 3 in reverse video and again press the Enter key to accept the second digit and move the cursor to the third digit position.

Repeat this procedure, following *Figure 2.6*, until all the passcode digits have been entered. On successful entry of the last digit (6), the top level Main Menu is displayed.

If the passcode is incorrectly entered, the passcode screen is displayed, showing the entries that have been made and the input cursor is placed over the first digit. To accept any digit as correct and to step to the next digit position, press the Enter key. Change the incorrect entry, using either the ▲ (up) or ▼ (down) keys and when a correct PIN has been entered, the top level Main Menu will be displayed.

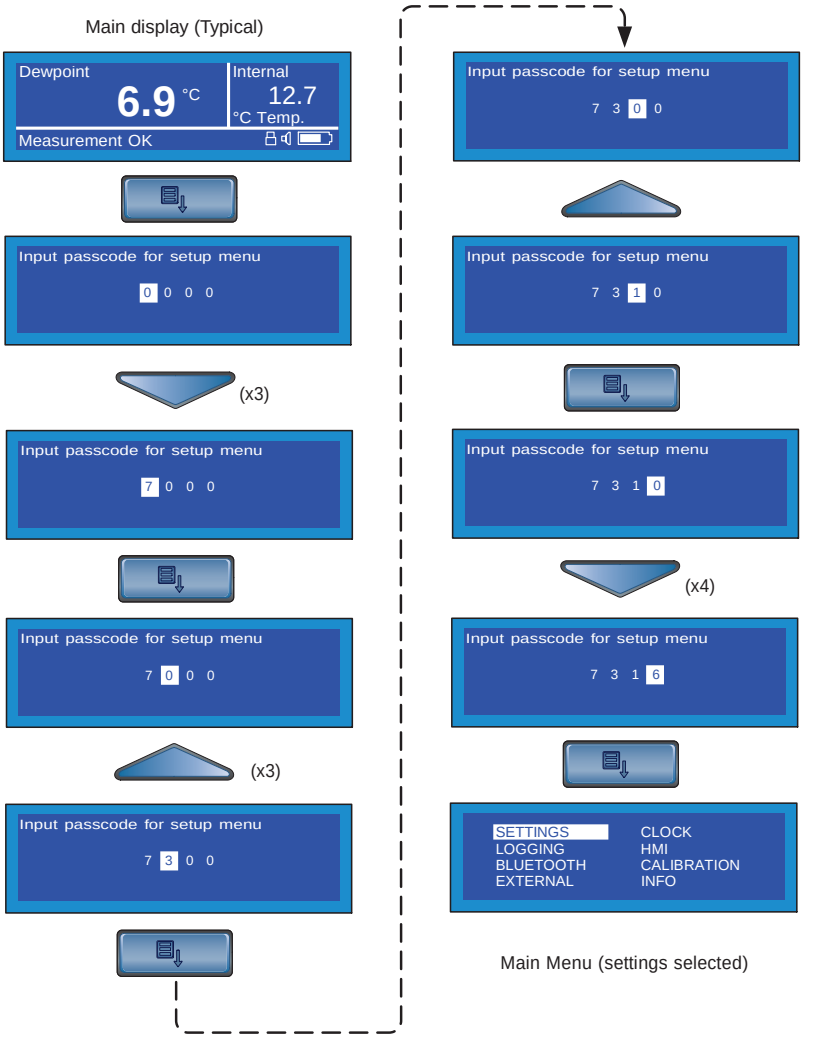


Figure 2.6 *Passcode entry*

2.6 Overall Menu Structure

The HygroPort I.S. instrument has a three level menu structure, the top level of which (Main Menu), is accessed from the Main Display by pressing the Enter key and entering the passcode as detailed in Section 2.5.

Within this Main Menu, eight options are available: **SETTINGS, LOGGING, BLUETOOTH, EXTERNAL, CLOCK, HMI, CALIBRATION** and **INFO**. These options are selected by using the scroll up and scroll down keys. As each option is highlighted, it is presented in a reverse video box. Pressing the Enter key provides access to a sub-level menu which permits the variables associated with that option to be edited. The sub-menu associated with each Main Menu option is shown.

Within each group of sub-level menus, the scroll up and scroll down keys are used to highlight each field within the group and the Enter key is used to select the field. Once a field has been selected, the scroll up and scroll down keys are then used to edit the parameter value associated with that field. The new value is then entered by pressing the Enter key.

After accepting a new value, quit the sub-menu by pressing the scroll left key which returns the operator to the Main Menu. From the Main Menu either, select another second level menu, or press the scroll left key again which returns the operator to the passcode entry screen. Pressing the scroll left key again returns to the main display.

The following sections describe the various second level sub-menus.

From the main display, pressing the scroll right key causes the chart to be displayed. The chart interval is set up under the Settings option of the main menu.

Pressing the scroll right key when the chart is displayed will cause either the log files to be displayed (if data logging is not selected), or the Logs page (current data) if logging is selected. If logging is not selected, pressing the Enter key will enable a shortcut to the datalog Set-Up Menu. Where more than one page of data is available, either for log files or log data, the scroll up and scroll down keys are used to scroll through the available list.

To prevent unauthorized correction of the instrument's calibration tables, entry to the calibration menu is protected by an additional passcode PIN. The method of entry is the same as that described in Section 2.5 (see also Figure 2.6), except that a Cal PIN replaces the Settings PIN (refer to Section 7.3).

Within the Calibration routines, automatic recognition of an external Kahn Easidew I.S. transmitter is provided, which causes the relevant calibration table to be displayed (refer to Section 1). The Info page, accessible from the main menu page, provides system information, Firmware Issue No., Serial No., Calibration Due Date and Sensor Hours Run.

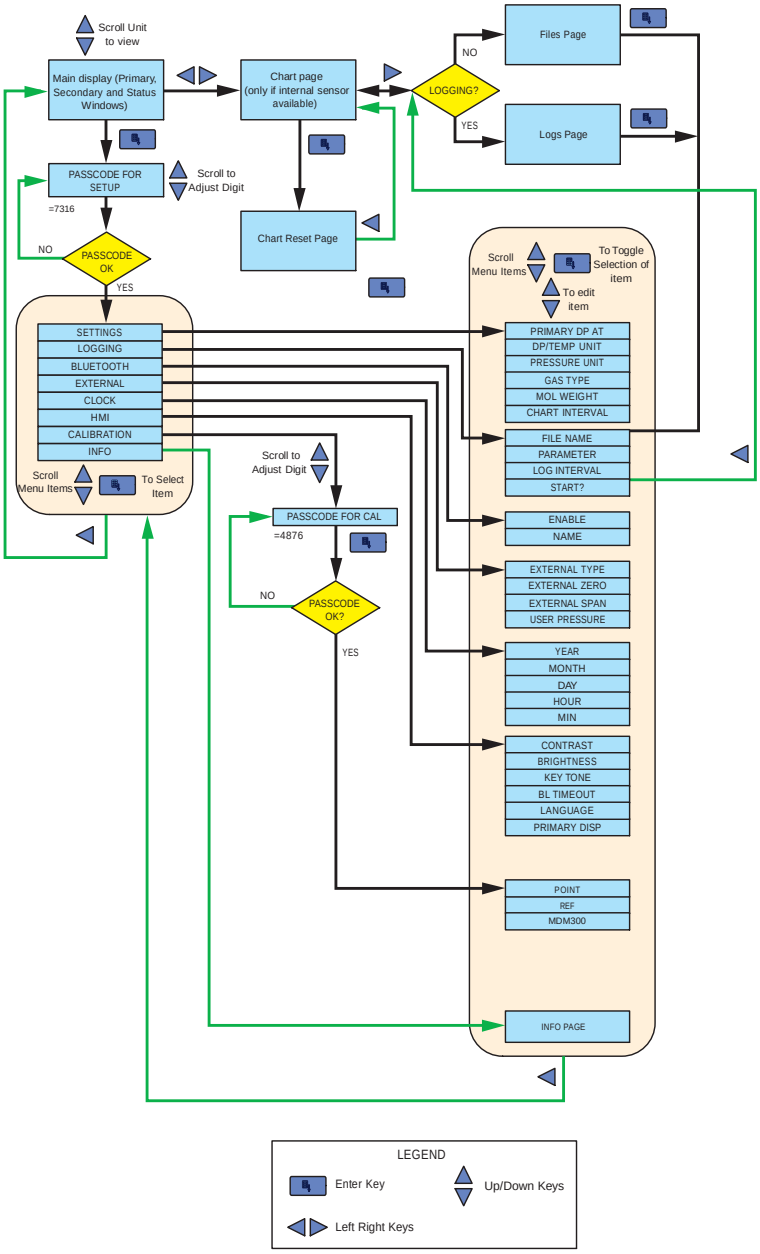


Figure 2.7 *HygroPort I.S. menu structure*

2.6.1 General Settings

When the main menu is first entered, the general **SETTINGS** option is highlighted in reverse video. This is the general Settings option and the associated menu (Figure 2.8), is displayed by pressing the Enter key.

Figure 2.8 *General Settings menu*

Initially, the **PRIMARY DP AT** field is highlighted. This field selects whether the instrument has been set up to take readings at atmospheric pressure or system pressure. To enter the parameter value field, press the Enter key. The current setting, i.e. **ATMOS**, is then highlighted.

To change this field value, press the Enter key and use either the scroll up or scroll down keys to select the required value and then press the Enter key to accept it. An example of the key sequence for changing the field value from **ATMOS** to **PRESS** is shown in Figure 2.8.

To access the other settings, use the scroll up or scroll down keys to select the required parameter, press the Enter key and proceed in a similar manner as described above.

Table 2.3 details the field values. To quit, press scroll left key.

Parameter	Parameter variable options
PRIMARY DP AT	**ATMOS** or **PRESS** (Atmospheric or Pressure). Indicates if the primary display sensor is at atmospheric or pressure
DP/TEMP UNIT	°C, °F or K (sets system temperature units)
PRESSURE UNIT	psig, bar, KPa, bara, psia, MPa (sets system pressure units)
GAS TYPE	Air, N_2, USER, CO_2, SF_6 (defines the sample gas type) The **MOL WEIGHT** field is automatically set internally for all gases except **USER** i.e reads **N/A** for all gases other than **USER**. For any other type of sample gas, the molecular weight of the gas must be defined in the **MOL WEIGHT** field.
MOL WEIGHT	Used to set molecular weight of a user-defined sample gas (Range 1 to 99) Defaults to 1 when field first selected
CHART INTERVAL	Sets chart time interval. Range 1 to 60 sec, default value 5

Table 2.3 General Settings

2.6.2 Logging

Highlight **LOGGING** from the Main Menu by using a combination of the ▲ (up) and ▼ (down) keys and press the Enter key. The Logging Set-up menu, is then displayed, see Figure 2.9.

Initially the **FILE NAME** field is highlighted. This field is used to define a name for a new log file and can be any combination of Alphanumeric characters (max 8 digits). NOTE: If a file name is not entered, a logging cycle cannot be started.

To enter the parameter value field press the Enter key. A prompt (-) for the first character is then highlighted. Use a combination of the scroll up and scroll down keys to insert the first character and then the scroll right key to shift to the second character position.

Repeat the above procedure until all characters have been entered and press the Enter key.

Set up the **PARAMETER** to be logged and the **LOG INTERVAL** in a similar manner.

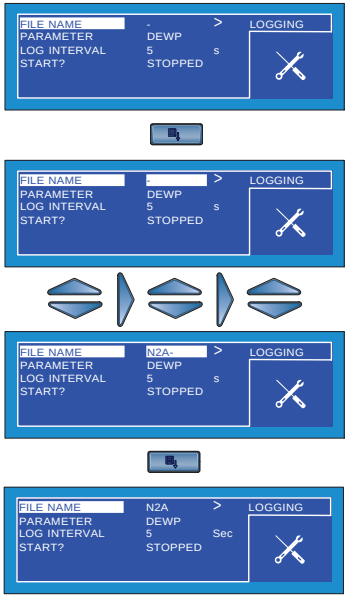


Figure 2.9 *Set-up Logging menu*

After setting up the logging parameters, start the log cycle by selecting **START?**. Press the Enter key to highlight **STOPPED** and use the scroll down key to change the field value to **STARTED**. Press the Enter key to start the logging cycle.

Table 2.4 details the field values. To quit, press the scroll left key.

Parameter	Parameter variable options
FILE NAME	Defines datalog file name. Field width up to eight alpha- numeric characters. Set with the scroll up, scroll down, scroll right and scroll left keys (NOTE: Scroll left ◄ deletes characters)
PARAMETER	Sets parameter to be logged. This need not necessarily be the same as that displayed on the Main Display. Options available, DEWP, GM^3, GKG, RH, PPMW, PPMV, CALC DP
LOG	Sets Log Interval in 5 sec increments. Range 5 to 600 seconds
INTERVAL	
START ?	Controls datalog Start and Stop functions. Logging cannot be started if a file name has not been defined. Once started, log file parameter felds are locked out and cannot be changed.

Table 2.4 Logging parameter set up

2.6.3 Bluetooth Settings

WARNING: Bluetooth operation is not permitted in hazardous areas.

Highlight BLUETOOTH from the Main Menu by using a combination of scroll up and scroll down keys and press the Enter key. The Bluetooth Set-Up Menu, is then displayed, see Figure 2.10.

Initially the ENABLE field is highlighted. This field is used to turn the Bluetooth function on and off.

To enter the parameter value field press the Enter key. The current field setting, "NO", will now be highlighted.

To enable the Bluetooth function, use the scroll down key to change the field setting to "YES" and press the Enter key.

Figure 2.10 *Bluetooth settings*

Bluetooth is now running. NOTE: A status message *in Bluetooth mode* is now displayed and this screen now remains until the Bluetooth mode is cancelled by pressing the scroll up key.

To change the Instrument's default Bluetooth address for pairing operations (refer to Section 4.7): Before enabling Bluetooth as described above, enter the NAME field using the scroll down key and press the Enter key.

With the NAME field now highlighted, using a combination of the scroll up, scroll down, scroll right and scroll left keys, select each digit position of the name and change to the required value. Press the Enter key when the correct name has been fully entered.

Table 2.5 details the field values. To quit, press the scroll left key.

Parameter	Parameter variable options
ENABLE	Field used to turn the Bluetooth facility on. Press Enter key to select. Select **NO** or **YES** with the ▲ (up) or ▼ (down) key, followed by the Enter key
NAME	Used to set up a Bluetooth name (address) for the instrument. Maximum eight alphanumeric characters. Default name set is HygroPort I.S. *To apply a new name: this must be set up before the Bluetooth mode is enabled and the instrument must be re-set*

Table 2.5 Bluetooth settings

2.6.4 External Sensor Interface

ONLY an Easidew I.S. Transmitter should be connected if the HygroPort I.S. is to be used in a hazardous area. The Easidew I.S. must be connected using the I.S. barriers required by CE-ATEX, FM, or CSA certification. A Kahn Remote Sensor Interface module is also required.

Highlight EXTERNAL from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key. The External Set-Up Menu, is then displayed, see Figure 2.11.

Initially the EXTERNAL TYPE field is highlighted. This field is used to select a Kahn Easidew I.S. Transmitter.

To enter the parameter value field press the Enter key. The current setting i.e. NONE, is then highlighted and can be changed. Use either the scroll up or scroll down keys to select EASIDEW and then press the Enter key.

Figure 2.11 illustrates the selection of an Easidew I.S. transmitter. NOTE: The ZERO and SPAN limits are automatically added for this transmitter.

Use the scroll up and scroll down keys to select each parameter that needs to be entered in turn and press the Enter key.

A user pressure can also be selected. This pressure is used in the calculation of dew point at pressure, moisture content and absolute humidity. If a user pressure is not selected then HygroPort I.S. assumes atmospheric pressure.

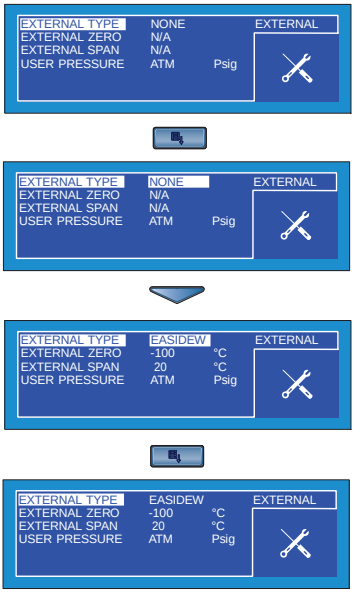


Figure 2.11 *External transmitter*

Table 2.6 details the field values. To quit, press the scroll left key.

Parameter	Parameter variable options
EXTERNAL TYPE	Defines use of Easidew I.S. transmitter. **ZERO** and **SPAN** (fullscale) default limits are pre-programmed but can be redefined
EXTERNAL ZERO	Defines external zero (lower limit). The **ZERO** default limit is pre-programmed but can be redefined
EXTERNAL SPAN	Defines external span (upper limit). The **SPAN** (full scale) default limit is pre-programmed but can be redefined
USER PRESSURE	Range 0-5000 psig (or equivalent in other units). Used to define system pressure, for use in calculating moisture parameters

Table 2.6 External transmitter selection

2.6.5 Real Time Clock Settings

Highlight CLOCK from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key. The Clock Set-Up Menu is then displayed, see Figure 2.12.

Initially the YEAR parameter of the instrument's real time clock is highlighted and the current year is displayed in 2 digit format, i.e. "11" for 2011.

To select any other parameter field, use either the scroll up or scroll down keys to highlight the required parameter and then press the Enter key to enter the value field for that parameter e.g. HOUR.

The current setting e.g. 09, is then highlighted and can be changed by using either the scroll up or scroll down keys. Holding either key will cause the value to continually increase or decrease. Press the Enter key to accept the value.

Figure 2.12 illustrates a typical real time clock set-up screen and shows the selection and changing of the HOUR parameter from 9:32 to 10:32.

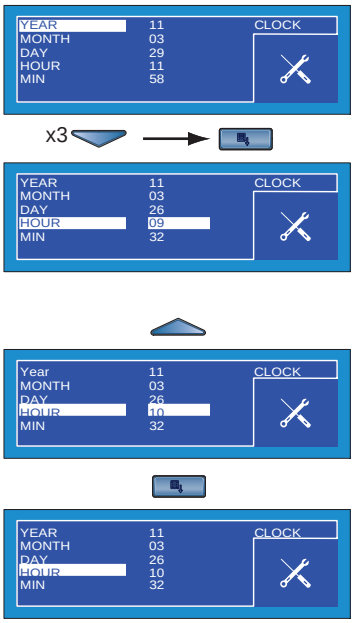


Figure 2.12 *Real time clock settings*

Table 2.7 details the field values. To quit, press the scroll left key.

Parameter	Parameter variable options
YEAR	**Range 00 to 99.** Scroll value with the scroll up or scroll down keys, accept value with the Enter key.
MONTH	**Range 01 to 12.** Scroll value with the scroll up or scroll down keys, accept value with the Enter key.
DAY	**Range 01 to 31.** Scroll value with the scroll up or scroll down keys, accept value with the Enter key.
HOUR	**Range 00 to 23.** Scroll value with the scroll up or scroll down keys, accept value with the Enter key.
MIN	**Range 00 to 59.** Scroll value with the scroll up or scroll down keys, accept value with the Enter key.

Table 2.7 Real time clock settings

2.6.6 HMI Settings

To enter the HMI menu, highlight HMI from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key. The HMI Set-Up Menu is then displayed, see Figure 2.13.

Initially the CONTRAST parameter is highlighted and the current setting, e.g. 50%, is displayed.

To select any of the other parameter fields, use either the scroll up or scroll down keys to highlight the required parameter and then press the Enter key to enter the value field for that parameter i.e. PRIMARY DISP.
NOTE: This option is only accessible if an external transmitter has been configured.

The current setting i.e. INTERN is then highlighted and can be changed by using either the scroll up or scroll down keys.
Press the Enter key to accept the value.

Figure 2.13 shows an HMI set-up screen and the method of changing the primary display to show the output of either the internal sensor (INTERN) or the external transmitter (EXTERN).

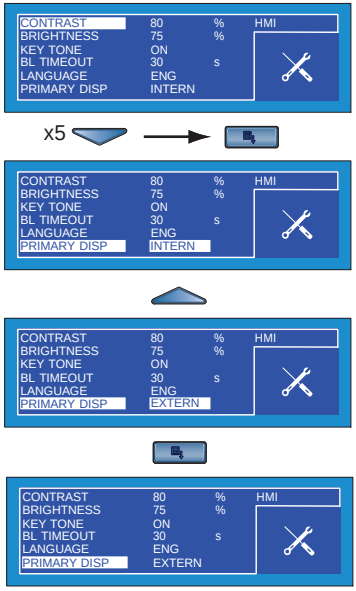


Figure 2.13 *HMI settings*

Table 2.8 details the field values. To quit, press the scroll left key.

Parameter	Parameter variable options
CONTRAST	**0 to 100% in 5% increments.** Scroll value with the scroll up or ▼ (down) keys, accept the selection with the Enter key.
BRIGHTNESS	**0 to 100% in 5% increments.** Scroll value with the scroll up or scroll down keys, accept the selection with the Enter key.
KEY TONE	**ON, OFF.** Toggle with the scroll up or scroll down keys, accept The selection with the Enter key.
BL TIME-OUT (Backlight control)	**OFF, 15 to 60 sec** in 15 sec increments**.** Scroll value using the scroll up or down keys, accept the selection with the Enter key.
LANGUAGE	**ENG, DEU, ESP, FRA, ITA, POR** Select with the scroll up or scroll down keys, accept the selection with the Enter key.
PRIMARY DISP	**INTERN, EXTERN.** Set with the scroll up or scroll down keys, accept the selection with the Enter key.

Table 2.8 HMI settings

2.6.7 Calibration

To enter the Calibration Menu, highlight CALIBRATION from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key.

Entry to the Calibration Menu is protected by a PIN. The PIN (4876) is entered in a similar manner to that described in Section 2.5. Section 7 details the use of the calibration routines.

WARNING: ***These procedures require the use of specialized test equipment and calibration adjustments should only be carried out by qualified personnel.***

Figure 2.14 shows the calibration screen for HygroPort I.S. calibration correction.

This screen gives access to the selected sensor's calibration look-up table and provides the facility to select and change any single point, or number of points, by means of the scroll up, scroll down, scroll right and scroll left keys. After all the changes within the look-up table have been made, they are accepted by pressing the Enter key.

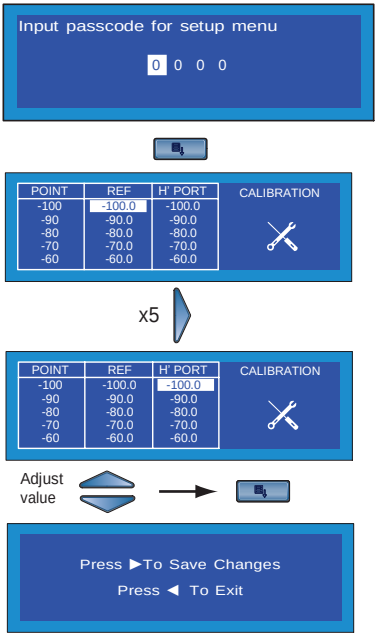


Figure 2.14 *Calibration*

No changes are then implemented until the scroll right key is pressed at the Exit screen. To exit without implementing any changes, use the scroll left key.

2.6.8 Info

To enter the Information menu, highlight INFO from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key.

This screen contains system information and no changes can be made.

To exit the screen, press the scroll left key.

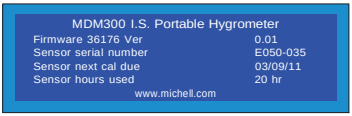


Figure 2.15 *Info screen*

2.6.9 Chart Options

A chart displaying a graph of the value of the selected internal sensor parameter with respect to time may be obtained by pressing the scroll right key from the Main menu. No chart can be displayed if the internal transmitter is not available.

Figure 2.16 shows a typical chart plot.

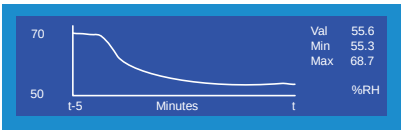


Figure 2.16 Typical chart plot

The X-axis (time) has a default range of 5 min and the graph is incremented (drawn) at the interval set up under SETTINGS (see Section 2.6.1). The Y-axis shows the measured value, with respect to time.

The current, maximum and minimum values of the displayed parameter are shown to the right of the plot and the units of the selected parameter are displayed below these readings.

The chart can be re-set at any time by pressing the Enter key.

This provides options to either re-set the chart by pressing the scroll right key or to return to the chart, without re-setting, by pressing the scroll left key.

A typical key sequence is shown in Figure 2.17.

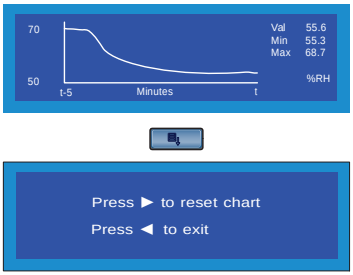


Figure 2.17 Re-set chart

If the instrument is not logging, pressing the scroll right key, while the chart is displayed, provides a list of all the previously saved log files, together with an indication of the available memory capacity (see Figure 2.18). To scroll through the list, use the scroll up and scroll down keys as required.

The content of the datalog files cannot be examined but, by enabling the instrument's Bluetooth mode, (see Section 2.6.3), the HygroPort I.S. application files may be used to upload the datalog files to a PC.

While in the datalog file list screen, a shortcut to the LOGGING Set-Up Menu is provided by pressing the Enter key. Refer to Section 2.6.2 for Logging set up details.

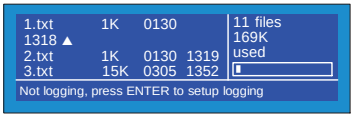


Figure 2.18 Datalog file list

When the chart is displayed, and the instrument is in the logging mode, if the scroll right key is pressed, the current log file is displayed (see Figure 2.19).

The scroll up and scroll down keys are both active while the log file is being displayed. To view log points taken earlier in the logging cycle, press the scroll up key. To continuously scroll back, hold the key down.

Similarly, to move forward in the list press the scroll down key, once for a single step, or press and hold to continuously scroll forward.

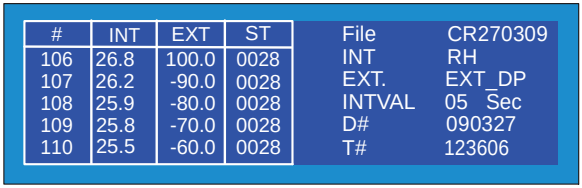


Figure 2.19 Current log file

The display reports the file name, i.e. CR270309; the primary (INT) display parameter that is being logged, i.e. RH; the secondary display (EXT) being logged, i.e. EXT_DP; and the logging interval, i.e. 05 Sec.

Additionally, the current date D#, in YYMMDD format (090327), and time T#, in HHMMSS format, (123606) are also displayed. NOTE: The chart and datalogging are independent functions; therefore the parameter displayed on the chart may not necessarily reflect what is being logged.

The number sign (#) column indicates a log number for each set of log points - log points 106 to 110 being shown in this example.

The ST column is a status column which reports the status of the instrument at each log point in hexadecimal code. The status codes are explained in Appendix C.

To return to the chart, press the scroll left key.

3 SET UP

3.1 Safety

Only qualified personnel should be permitted to connect the HygroPort I.S. electrically and mechanically to the sample gas.

3.2 Unpacking the Instrument

The HygroPort I.S. instrument is packed into a standard box and the method of unpacking is shown in Figure 3.1.

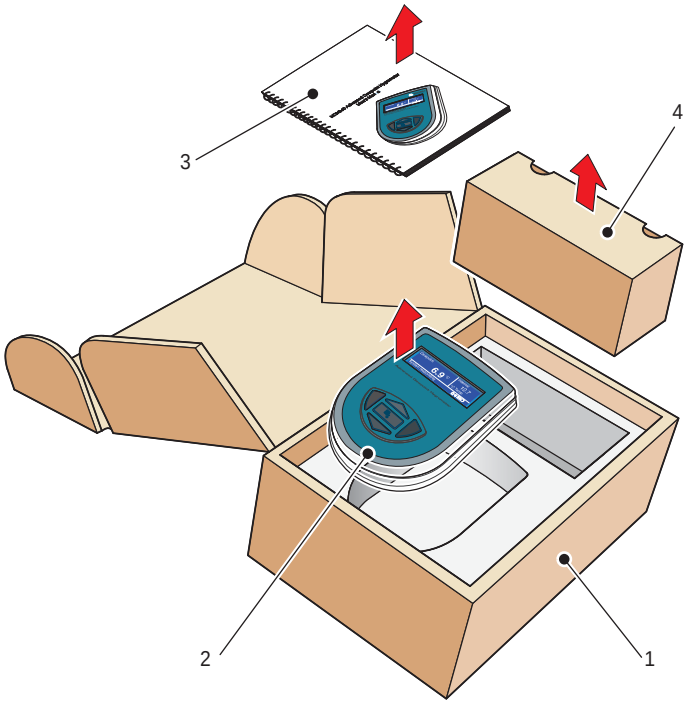


Figure 3.1 *Packing method*

Open the box (1) and unpack carefully. Remove the HygroPort I.S. instrument (2), the User's Manual (3) and the accessories box (4).

Save all the packing materials for the purpose of returning the instrument for re-calibration or any warranty claims.

3.3 HygroPort I.S. Accessories

The accessories for the HygroPort I.S. are shown in Figure 3.3. Items 1 to 6 are supplied as standard and item 7 is optional . Please check that all the standard components are present after unpacking. Report any shortages immediately.

1. Calibration Certificate
2. User's Manual
3. Charger Unit (North American charger plug adapter shown installed)
4. Gas Input/Output Port Adaptor (three provided – two installed on the instrument)
5. Application Software CD
6. Quick-Start Guide
7. Carrying Case - made from anti-static materials suitable for use in hazardous areas (optional)

Three gas input port adaptors (item 4) are provided, two with a large orifice and one with a small orifice. Depending upon configuration, this permits the instrument to be run at either system pressure or atmospheric pressure and facilitates the connection of external flow monitoring and control.

The accessory pack contains a large orifice adaptor. The remaining adaptors are inserted into the instrument's gas ports (1 and 2) as shown in *Figure 3.2.*

NOTE: On delivery two large orifice adaptors are installed on the instrument. One small orifice adaptor is provided as a loose spare (see Section 3.5).

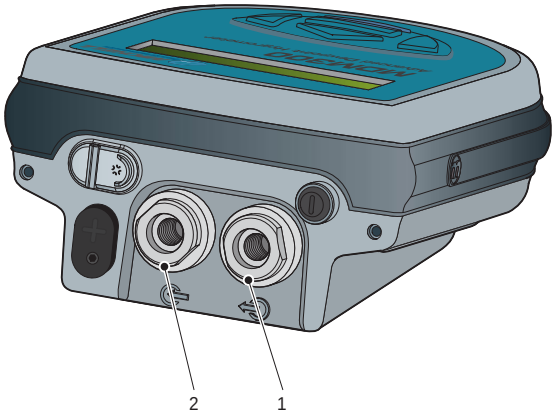


Figure 3.2 *Gas port adaptors*

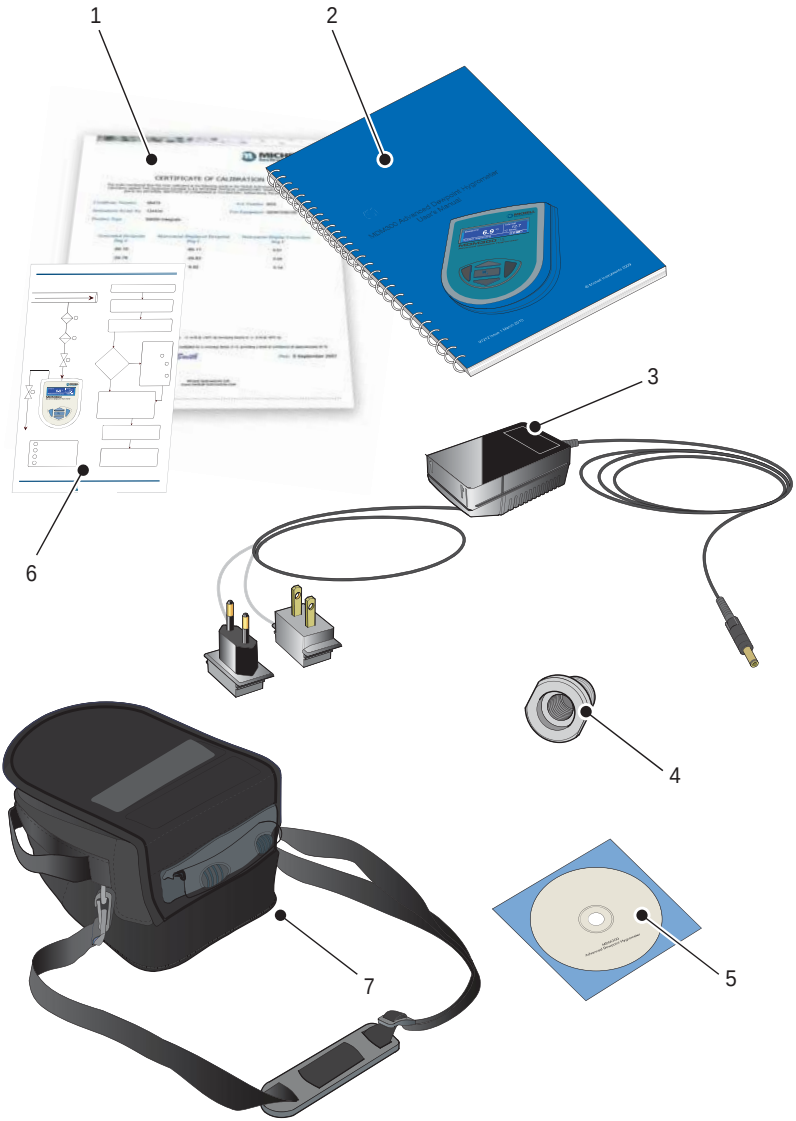


Figure 3.3 Accessories

3.4 Operational Requirements

Operational requirements are as follows:

Sample gas flow rate:	0.4 to 1.0 scfh
Operating pressure:	0 to 5000 psig

3.4.1 Environmental Requirements – HygroPort I.S. Instrument

Operating temperature range:	-4 to +122°F (-20 to +50°C)
Humidity:	0 to 100% RH (non-condensing)
Altitude:	Up to 6562 ft (2000m)

3.4.2 Charger Electrical Requirements

Charger supply voltage:	100 V to 240 V AC (+10%, -15%) 50 to 60Hz (±5%), 8 VA

3.5 Instrument Gas Connections (Figures 3.2 and 3.4)

POSSIBLE INJURY! The tubing, valves and other apparatus attached to this instrument must be adequate for the maximum pressure which will be applied, otherwise physical injury to the operator or bystander is possible.

Sample gas connections are made via the Gas In (2) and Gas Out (1) ports located on the rear of the instrument as shown in *Figure 3.2*.

The HygroPort I.S. is supplied with a sintered disc filter installed in the Gas In port, and with a large bore orifice fitting installed in each of the gas ports. These fittings have an 1/8" NPT female thread to allow the user to connect other components of their choice. A range of available fittings and sample flow accessories are shown in Figure 3.4.

Atmospheric pressure or system pressure dewpoint can be measured depending on the configuration of the orifice fittings shown in Table 3.1.

For gas pressures outside the range 15-150 psig (1 to 10 bar), the instrument requires external flow control components, as shown in Figure 3.4.

Dew point at	Gas Inlet port fitting	Gas Outlet port fitting	Sample gas pressure
Atmospheric	Small bore orifice	Large bore orifice	15-150 psig (1 to 10 bar)
System	Large bore orifice	Small bore orifice	15-150 psig (1 to 10 bar)
Either (using other flow control components)	Large bore orifice	Large bore orifice	0-5000 psig (0-350 bar)

Table 3.1 Adaptor fittings

3.5.1 Gas Inlet /Outlet Fittings

HIGH PRESSURE! High pressure gases are potentially hazardous. Energy stored in these gases can be released suddenly and with extreme force. High pressure systems should be assembled and operated only by individuals who have been trained in proper safety practices.

Before making a measurement, the gas fittings should be attached to the instrument as per Table 3.1 and *Figure 3.4.*

1. Install the required orifice fittings.
2. Install any adaptors that might be required.
3. If the small bore orifice fitting is not used then one of the optional application kits could be installed (as shown in Figure 3.4).

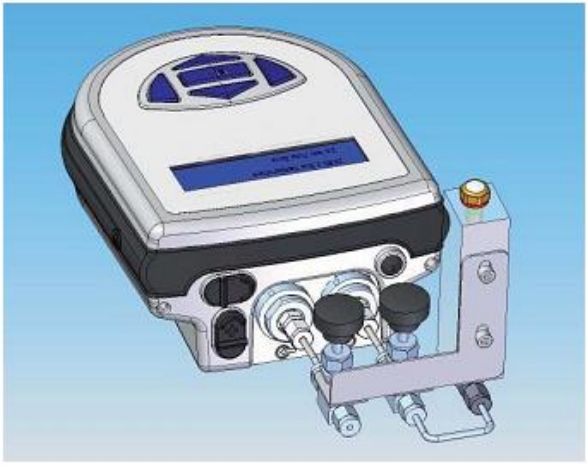


Figure 3.4 *Gas coupling examples for atmospheric pressure measurement*

NOTE: The application kit shown in Figure 3.4 (excluding the orifice fittings) is not supplied as standard, but is part of a range of kits which can be ordered from Kahn Instruments, on request.

3.6 Connect External Transmitters

The HygroPort I.S. can be configured for connection to a Kahn Instruments' Easidew I.S. Transmitter (CE-ATEX 06ATEX0330C, IECEx BAS 06.0090X, FM 3033475, CSA 201328), via the HygroPort I.S. Remote Sensor Interface, where the Easidew I.S. Transmitter is installed within a hazardous area.

The HygroPort I.S. Remote Sensor Interface is a passive device. The combined terminal parameters of the HygroPort I.S. and of the barrier used with the Easidew I.S. system must not exceed the input terminal parameters of the Easidew I.S. as specified in the System Drawing (System Certificate No. 07Y0027).

Figure 3.5 HygroPort I.S. Remote Sensor Interface

Refer to Appendix B (Hazardous Area Certification) for the HygroPort I.S. terminal parameters. Figure 3.6 shows the connection of the HygroPort I.S. Remote Sensor Interface to the HygroPort I.S. and the Easidew I.S. Transmitter.

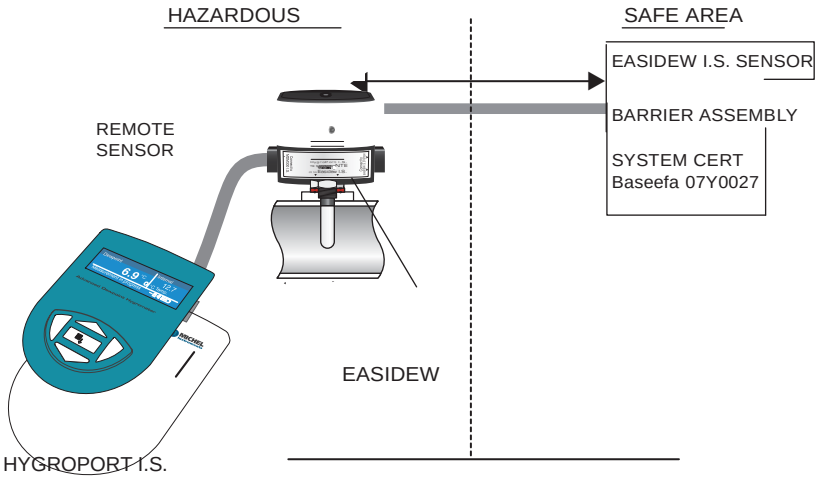


Figure 3.6 External transmitter connection

3.6.1 Set up External Sensor Interface

After selecting the Easidew I.S. Transmitter, the following parameters must be defined:

Switch on the instrument and set the required DP/TEMP units to either °C, °F or K from the SETTINGS option (refer to Section 2.6.1). Also set up the required pressure units.

Using the EXTERNAL option from the Main menu, set up the instrument for an external Easidew input as follows (refer to Section 2.6.4):

EXTERNAL TYPE	Select EASIDEW
EXTERNAL ZERO	-100°C (DP Temp represented by 4mA input - can be re-set)
EXTERNAL SPAN	20°C (DP Temp represented by 20mA input - can be re-set)
USER PRESSURE	Set as required for application (ATMOS or pressure level)

After completion of the above settings, return to the Main menu; the instrument will now display dewpoint from the external sensor in the secondary display area, and the selected units. An example is shown in *Figure 3.7.*

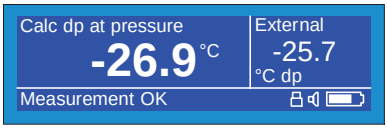


Figure 3.7 Typical external dewpoint display

3.6.2 Entering User Pressure

The HygroPort I.S. can be programmed with a pressure to be used in the calculation of atmospheric equivalent or pressure dewpoint, moisture content or absolute humidity. **NOTE: Care should be taken to insure that the entered pressure is correct as it may have a considerable effect on the measurement.**

Using the External option in the Main menu, set a user pressure as follows:

1. Scroll to **USER PRESSURE**.
2. Use the scroll up and scroll down keys to select either **ATM** (for atmospheric pressure), or the required pressure.

NOTE: The pressure units are selected in the SETTINGS menu.

3.7 Connect Battery Charger

WARNING: The battery charger must NOT be connected within the hazardous area. The battery charger socket cover MUST be installed when the product is in use in a hazardous area.

The HygroPort I.S. is powered from a 4.8 V, internally mounted, rechargeable Nickel Metal Hydride (NiMH) battery. Typically, depending upon the instrument settings, the battery will provide approximately 24 hours of continuous operation when fully charged.

A graphical display of battery charge state is provided and an audible warning is given as the battery approaches full discharge. **NOTE: Do not allow the battery to fully discharge: doing so may result in difficulty with recharging**.

Loosen the securing screw and swing aside the sealing cover (2). Insert the battery charger connector (1) into the charger connector as shown in Figure 3.8.

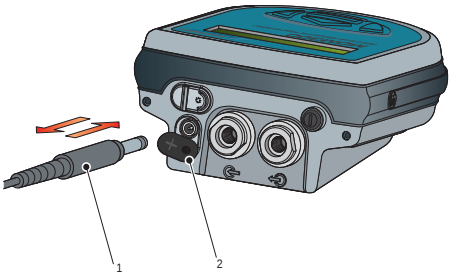


Figure 3.8 *Connect battery charger*

Connect an AC power supply, 110-240 V, 47-63 Hz, to the battery charger unit.

NOTE: The HygroPort I.S. instrument does not need to be switched on in order to charge the battery.

The battery charger supplied is a "Smart" charger.

WARNING: Only use the charger supplied with the HygroPort I.S. The use of any charger other than that supplied with the HygroPort I.S. will invalidate the product warranty.

When initially connected, a charge indicator LED, located on the top of the charger, slowly flashes yellow, indicating that the charger has entered a pre-charge cycle.

After a short period this indicator starts to rapidly flash green, indicating that a fast charge cycle (approximately 2 hours), is now in progress. As the battery approaches full charge, the LED starts to flash green, more slowly, indicating that a "topping-off" charge is now, being applied.

At the end of the topping-off charge, the charge indicator LED assumes a steady green state, indicating that the battery charge cycle is now complete. Turn off the AC power supply, remove the charger unit and close the instrument's charge connector protection cover.

A battery that has been discharged to the point of audible warning will be 50% charged after 30 minutes or fully charged after approximately 2 hours.

4 OPERATION

High pressure gases are potentially dangerous. Please see the warning in Section 3.5.1

4.1 Preparation for Operation

Before operation it is recommended that the user become familiar with Section 2 of this Manual in which all the equipment controls and indicators, the elements of the display and the overall menu structure are described.

Prior to making a measurement, the instrument must be connected to a sample gas stream as described in Section 3.5.

It is also recommended that the battery be charged before conducting any tests (refer to Section 3.7).

Do not allow the battery to fully discharge. Doing so may result in difficulty recharging again.

The instrument will also have been set up with a number of factory default parameters. These default parameters are shown in Table 4.1, together with a reference to the relevant part of Section 2, which details the method of changing these default values.

4.2 General Operational Information

The instrument is designed to operate in a flowing gas stream of between 0.4 and 1.0 scfh (0.2 and 0.5 Nl/min) and at system pressures ranging from atmospheric up to 5000 psi (350 bar). Section 3.5 describes typical methods of connecting the instrument to a sample gas stream.

For all applications, the sample gas is taken into the instrument via the Gas In port, located on the top of the instrument, from where it passes through the internal sensor and out via the Gas Out port. Gas flow rate (if monitored) is normally measured externally, on the output side of the instrument.

The sample gas flow rate is not controlled or measured within the instrument. It must be controlled outside the instrument, typically by means of either fixed orifice fittings, or a needle valve. Kahn Instruments provides an optional range of accessories, specifically designed for use with the HygroPort I.S.

Parameter	Default Value	Associated Section Reference
SETTINGS		Section 2.6.1, *Figure 2.8*
PRIMARY DP AT	ATMOS	
DP/TEMP UNIT	°C	
PRESS UNIT	psi	
GAS TYPE	AIR	
MOL WEIGHT	N/A	
CHART INTERVAL	5 sec	
LOGGING		Section 2.6.2, *Figure 2.9*
FILE NAME	-	
PARAMETER	DEWP	
LOG INTERVAL	5 sec	
START?	STOPPED	
BLUETOOTH		Section 2.6.3, *Figure 2.10*
ENABLE	NO	
NAME	HygroPort	
EXTERNAL		Section 2.6.4, *Figure 2.11*
EXTERNAL TYPE	NONE	
EXTERNAL ZERO	N/A	
EXTERNAL SPAN	N/A	
CLOCK	Current time & date	Section 2.6.5, *Figure 2.12*
HMI		Section 2.6.6, *Figure 2.13*
CONTRAST	80%	
BRIGHTNESS	40%	
KEYTONE	OFF	
BL TIME-OUT	15 sec	
LANGUAGE	ENG	
PRIMARY DISP	INTERN	
CALIBRATION & INFO	Default values not applicable	Sections 2.6.7 & 2.6.8

Table 4.1 HygroPort I.S. default parameters

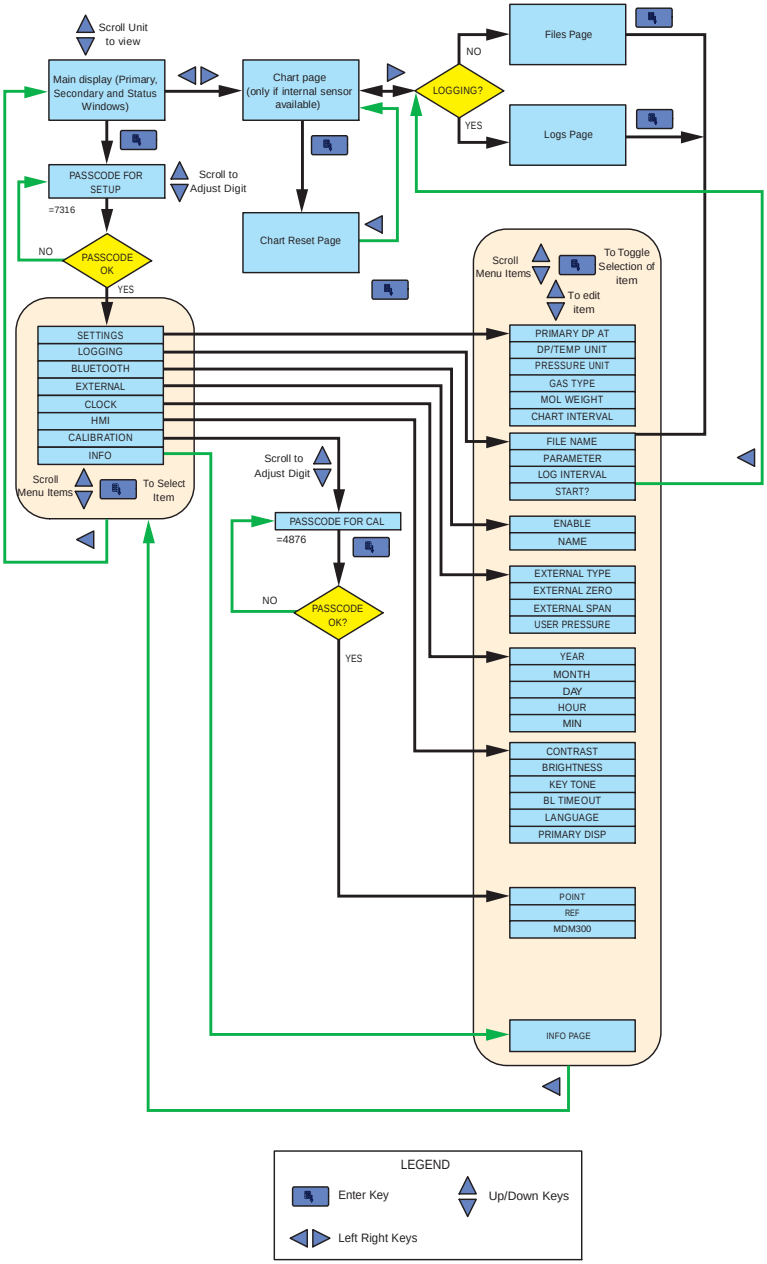


Figure 4.1 HygroPort I.S. menu structure

4.3 Operation Guide

Operating the HygroPort I.S at atmospheric pressure:

1. Connect the HygroPort I.S. to the sample gas stream, typically as shown in Section 3.5.
2. Use the inlet flow control valve to adjust the flow rate through the instrument to between 0.4 and 1.0 scfh (0.2 and 0.5 Nl/min).
3. Turn the instrument on using the rear mounted ON/OFF switch (item 3 in *Figure 2.1).* The instrument display will now illuminate, initially showing the start-up screen, followed by the initialization screen (see *Figure 4.2)*.
4. A 1 minute initialization period commences automatically, after which the screen will show a countdown of the remaining initialization time. During this period the sensor is heated to increase the mobility of water molecules and accelerate equilibrium with the passing sample gas. The status display will read **Initializing internal sensor.**
5. The instrument will then begin Measurement mode. During the first few minutes of Measurement mode it is normal to see the displayed moisture value drop rapidly below (undershoot) the actual moisture value, before returning to a stable reading.
6. The instrument display will show an initial measured value and provide a visual indication that the sensor is, at first, responding to the sample (status display shows **Measurement in Progress**), and a short time later, is measuring the true moisture value (**Measurement in Progress** message disappears).
7. Once **Measurement in Progress** has disappeared, the instrument is close to the final dewpoint. Depending on conditions, it may continue to respond for a number of minutes before tracking the measured dewpoint.

Note: At the end of the initialization period, the instrument's menu structure can be entered, allowing the display parameters to be changed, datalogging to be set up and the Bluetooth mode to be enabled (refer to Sections 2.6.2 and 2.6.3).

Refer also to the Quick Start Guide for information on correct operation practice.

Operating the HygroPort I.S. at sample pressure:

1. Connect the HygroPort I.S. to the sample gas stream, typically as shown in Section 3.5.
2. Use the outlet flow control valve to adjust the flow rate through the instrument to between 0.4 and 1.0 scfh (0.2 and 0.5 Nl/min).
3. Turn the instrument on using the rear mounted ON/OFF switch (item 3 in *Figure 2.1).* The instrument display will now illuminate, initially showing the start-up screen, followed by the initialization screen (see *Figure 4.2).*

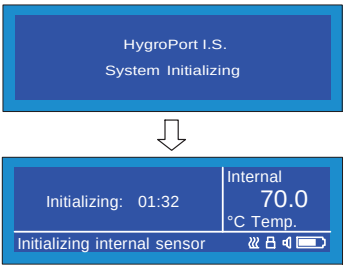


Figure 4.2 Initialization mode

5. A 1 minute initialization period begins automatically, after which the screen will show a countdown of the remaining initialization time. During this period the sensor is heated to to increase the mobility of water molecules and reduce the time taken to reach equilibrium with the passing sample gas. The status display will read **Initializing internal sensor.**

6. After the initialization period of between 4 to 7 minutes is complete, close the outlet flow control valve and open the inlet flow control valve. Then set the outlet flow control valve to provide a flow rate through the instrument of between 0.4 and 1.0 scfh (0.2 and 0.5 Nl/min).

7. After this, the instrument will commence Measurement mode. During the first few minutes of Measurement mode it is normal to see the displayed moisture value drop rapidly below (undershoot) the actual moisture value, before returning to a stable reading.

8. The instrument display will show an initial measured value and provide a visual indication that the sensor is, at first, responding to the sample (status display shows **Measurement in Progress**), and a short time later, is measuring the true moisture value (**Measurement in Progress** message disappears).

9. Once **Measurement in Progress** has disappeared, the instrument is close to the final dewpoint. Depending on conditions, it may continue to respond for a number of minutes before tracking the measured dewpoint.

Note: At the end of the initialization period, the instrument's menu structure can be entered, allowing the display parameters to be changed, datalogging to be set up and the Bluetooth mode to be enabled (refer to Sections 2.6.2 and 2.6.3).

Refer also to the Quick Start Guide for information on correct operation practice.

4.4 Graphics Display

While the primary display is indicating internal sensor parameters a graphical display of the output can be obtained by pressing the scroll right key. An example of a chart is shown in Figure 4.3. **NOTE: If an external transmitter has been configured, the chart will display the internal dewpoint.**

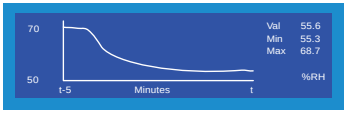


Figure 4.3 Typical chart display

The chart can be re-set at any time by pressing the Enter key followed by the scroll right key.

Section 2.6.9 describes the chart options.

4.4.1 Display Datalog File List

Provided the instrument is not logging, the Datalog File List displays a complete list of all the currently stored datalog files, together with the amount of memory space available, by pressing the scroll right key when the chart is displayed. An example is shown in Figure 4.4.

Figure 4.4 Datalog file list

The current page of files is shown. If they are visible, the ▲ and ▼ arrows located to the right of the files display, indicate that a previous (▲) page and a following (▼) page are available for selection via the scroll up and scroll down keys.

To return to the chart press the scroll left key. To set up a new datalog file press the Enter key.

Datalog files can be uploaded to a PC via a dedicated HygroPort I.S. application software package by first enabling the instrument's Bluetooth facility and pairing it with a PC which has the software application package installed (refer to Section 4.7).

4.4.2 Display Current Datalog File

To display the current log file, while the instrument is logging, press the ▶ (right) key when the chart is displayed. A typical log file is shown in *Figure 4.5*.

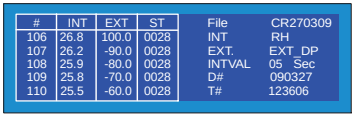


Figure 4.5 Typical log file display

The current page of the log file is shown. Log files start at 1. To view log plots earlier or later than the currently displayed page use the scroll up and scroll down keys.

To return to the chart, press the scroll left key. Section 2.6.9 gives further details.

4.5 Logging

Logging can be set up either from the Logging Menu or from the Chart option (see Section 4.4.1). Both methods of entry lead to the same set-up menu as shown in *Figure 4.6*.

Figure 4.6 Logging set-up menu

To set up a log file the general procedure is as follows (Section 2.6.2 details the full procedure):

1. Enter a file name.
2. Enter the name of the parameter that requires logging. **NOTE: This need not necessarily be the same as that in the primary display (or chart)**
3. Enter the log interval (5 to 600 seconds in 5 second increments).
4. Start the log file by entering the **START?** field, selecting **STARTED** with the scroll down key, and pressing the Enter key.

After the log file has been started, quit the **LOGGING** option by pressing the scroll left key and return to a required previous screen, e.g. pressing three times returns to the Main menu with the Logging display icon in the status line.

4.6 Bluetooth Mode

WARNING: Bluetooth operation is not permitted in hazardous areas.

Bluetooth mode is used, in conjunction with a dedicated HygroPort I.S. application software package, for the purpose of uploading datalog files to a PC using a wireless connection. Within the PC the dedicated Kahn application software package is used to upload the files to the PC's desktop, from where they can be loaded into other programs, e.g. Microsoft Excel®, for further examination and processing.

The Bluetooth Set-up menu is entered from the BLUETOOTH Menu and is shown in Figure 4.7.

Figure 4.7 Bluetooth set-up menu

The general set-up procedure is as follows (refer to Section 2.6.3):

1. Enter an instrument name. Initially, when the instrument is delivered, a name will have been allocated (i.e. HygroPort-AK2). **NOTE: If the name requires changing, do so before enabling the Bluetooth mode.**

2. Enable Bluetooth mode by changing the **ENABLE** field from **NO** to **YES** with the scroll down key and pressing the Enter key.

The instrument is now in Bluetooth mode. NOTE: When the instrument is in Bluetooth mode the Bluetooth screen remains displayed and no other menu options can be selected.

To quit the Bluetooth mode change the **ENABLE** field from **YES** to **NO** with the scroll up key and press the Enter key. Return to the Main menu by pressing the scroll left key twice.

4.6.1 Bluetooth Pairing Procedure

When the instrument is in Bluetooth mode, a pairing procedure needs to be carried out in order for the PC system to recognize the instrument. This procedure only needs to be carried out once for each instrument. A typical pairing procedure is outlined in *Figure 4.8.* The procedure is as follows:

1. From the PC's Bluetooth menu, search for devices in range. This yields the instrument named, i.e. HygroPort-AK2.

2. Double click the instrument icon and enter the instrument's pairing passkey (**7316**) for all HygroPort I.S. instruments. **NOTE: Each digit will be shown only briefly as it is entered and then hidden.**

3. When all digits have been entered click **Next**.

4. With the serial link established, click **Configure**. **NOTE: The name of the COM port allocated, i.e. COM7, will need to be entered when starting the Kahn application software.**

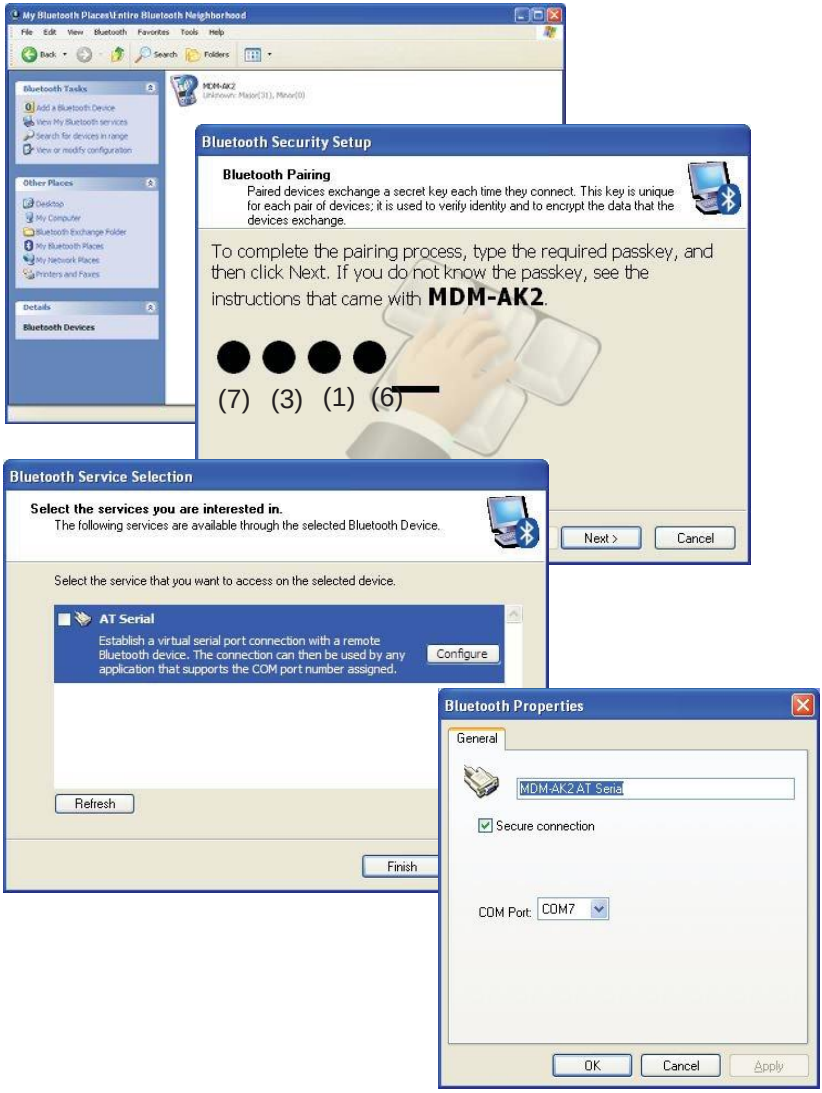

My Bluetooth Places\Entire Bluetooth Neighborhood
Bluetooth Tasks
Other Places
Details
Bluetooth Devices
Bluetooth Security Setup
Bluetooth Pairing
Paired devices exchange a secret key each time they connect. This key is unique for each pair of devices; it is used to verify identity and to encrypt the data that the devices exchange.
To complete the pairing process, type the required passkey, and then click Next. If you do not know the passkey, see the instructions that came with MDM-AK2.
(7) (3) (1) (6)
Next >
Cancel
Bluetooth Service Selection
Select the services you are interested in.
The following services are available through the selected Bluetooth Device.
Select the service that you want to access on the selected device.
AT Serial
Establish a virtual serial port connection with a remote Bluetooth device. The connection can then be used by any application that supports the COM port number assigned.
Configure
Refresh
Finish
Bluetooth Properties
General
MDM-AK2 AT Serial
Secure connection
COM Port:
COM7
OK
Cancel
Apply

Figure 4.8 Typical Bluetooth pairing sequence

4.8 Interchange Primary and Secondary Displays (HMI)

When an Easidew I.S. Transmitter has been configured, the primary and secondary displays can be interchanged to show the external transmitter reading as the main display and the internal sensor reading as the secondary display.

With an Easidew I.S. Transmitter connected, the ability to display the output of the external device as the main (large character) display can be particularly advantageous for a number of applications such as:

- Remote monitoring
- Calibration checks on an existing installation
- High pressure measurements

Interchanging the primary and secondary displays is effected from the HMI Menu.

To interchange the primary and secondary displays, proceed as follows:

1. From the Settings Menu, select **HMI.** An HMI Menu is shown in Figure 4.9.

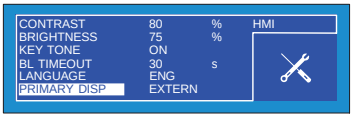


Figure 4.9 HMI set-up menu

2. Select **PRIMARY DISPLAY** and press the Enter key.
3. Change **INTERN** to **EXTERN** using the scroll down key and press the Enter key.

Section 2.6.6 describes, in greater detail, the set-up procedure and the various field options.

To quit the External Set-up Menu and return to the Main menu press the scroll left key three times. Figure 4.10 shows an external pressure transmitter configured as the primary display.

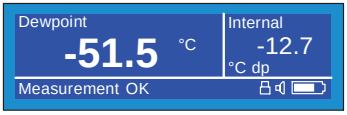


Figure 4.10 Typical 'external as primary' display screen

To change the primary display back from **EXTERN** to **INTERN**, repeat the above procedure using the scroll up key at step 3.

5 APPLICATION SOFTWARE

Application software for the HygroPort I.S. is supplied on a CD.

To install on a PC: place the CD in the CD drive and follow the instructions in the application set-up wizard. If the CD does not auto-run, double-click the application set-up file on the CD. The following authorization code will be required during the installation process: MDM-300-7392

Once the software has been installed and run, the HygroPort I.S. can be linked to the PC by activating the Bluetooth (see Section 4.6 for details).

The application software allows modification of all the instrument parameters from the connected PC. The settings currently stored on the HygroPort I.S. can be downloaded to the PC by clicking the '**Download from HygroPort I.S.**' button, and can then be changed and stored by clicking the '**Upload to HygroPort I.S**' button.

It also gives access to all logging files stored on the instrument's internal memory. These can be downloaded to a specific location by right clicking, and selecting '**download**'.

A context sensitive help file provides further details on the use of the application software.

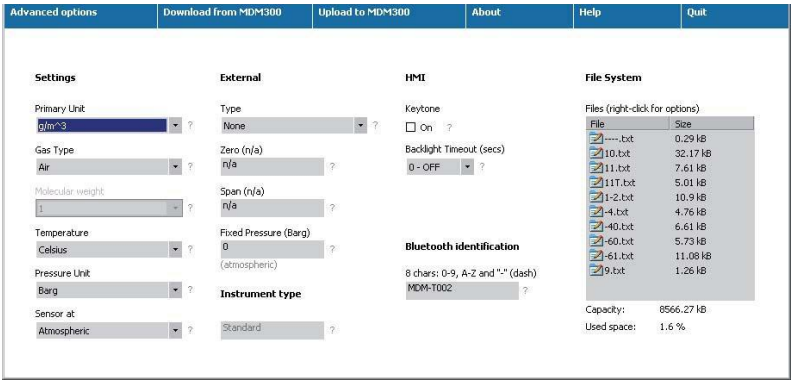


Figure 5.1 Typical application software screen

6 GOOD MEASUREMENT PRACTICE

The HygroPort I.S. is designed to operate in a flowing gas stream with flow rates between 0.4 and 1.0 scfh (0.2 and 0.5 Nl/min). Flow regulation is provided with the HygroPort I.S. instrument up to a 10 barg limit. Beyond this the sample flow must be regulated outside the unit.

There are a number of options for sample conditioning including a specifically designed sampling system and a variety of application kits. The flow rate can be regulated on the inlet or outlet depending on whether the intention is to measure at atmospheric or sample pressure. Up to 150 psig (10 barg), this can be achieved by use of the orifice fittings supplied with the instrument. Section 3.5.1 and Figure 3.4 show a typical arrangement for measuring non-hazardous gas at atmospheric or elevated pressure.

In applications where the sample gas has a very high flow rate it is advisable to use an instrument by-pass arrangement to provide the minimal flow rates which the sensor requires. Excessive flow restriction can cause back-pressure across the sensor leading to a discrepancy between the readings recorded and those expected.

Measurement of Dewpoints Drier than -70°Cdp

The HygroPort I.S. Sampling System is optimized for fast response. Therefore, when measuring very dry dewpoints, certain steps need to be taken to insure that the best accuracy is achieved:

1. Remove the sintered filter from the inlet port.
2. Make sure that all tubing and fittings used are made from stainless steel.

The purpose of this is to reduce the possibility of any moisture being trapped upstream of the sensor; prolonging the dry-down process; or permeating into the sample line through unsuitable tubing - such as PTFE.

Due to the significantly lower levels of moisture present at dewpoints of this level, the response times of the sensor will be significantly increased. The table below offers an approximate guide to the times taken for the instrument to stabilize at a given dew point (from a starting point of 10°Cdp ambient):

Target Dewpoint	T100 response time from ambient (hours)
-112°F (-80°C)	12
-130°F (-90°C)	48
-148°F (-100°C)	96

6.1 General Operational Guidelines

General guidelines to be followed when setting-up a sampling system are as follows:

- **Insure that the sample is representative of the gas under test**

  To insure that the sample is representative of the process being monitored, the sample point should be as close to the critical measurement point as possible. Also, never sample from the bottom of a pipe where entrained liquids may be drawn into the instrument's sample input line.

- **Minimize the "dead space" in sample lines**

  Dead space in sample lines causes moisture entrapment points, increased system response times or measurement errors as the trapped moisture is released into the passing sample gas, producing an increase in partial vapor pressure.

  Avoid the use of too many fittings, in-line couplings or other unnecessary tubing. Sample tubing should, ideally, be specially designed for each application rather than adapted from that previously installed for another application. Dead space in sample lines increases response time by holding water molecules which are more slowly released to the passing gas sample.

- **Remove any particulate matter or oil from the gas sample**

  Particulate matter can damage the sensors. If particulate matter, such as degraded desiccant, pipe scale and rust are likely to be present in the sample gas, use a particulate in-line filter. Kahn Instruments' Technical Sales Department can to provide advice on appropriate methods of filtration.

- **Use high quality sample tube fittings**

  The sample tubing must be capable of withstanding the operating pressure of the sample line. Wherever possible, always use stainless steel tubing and fittings. This is particularly important at low dewpoints since other materials, e.g. nylon, have hygroscopic characteristics and adsorb moisture on the tube walls, giving rise to slower measurement response and, under certain circumstances, false dewpoints. For temporary applications, or where stainless steel tubing is not practical, use high quality, thick-walled PTFE tubing, which exhibits similar qualities to stainless steel.

  In order to minimize response time, always use the shortest run of tubing and the smallest diameter possible. Take care not to induce pressure differentials by aiming for too high a flow rate through too small a diameter.

  Kahn Instruments supplies a range of precision pressure fittings suitable for use with the HygroPort I.S. instrument. Contact Kahn Instruments for details of the items available.

- **Gas samples**

  Gases containing entrained solids should be filtered before application to the instrument. Please consult Kahn Instruments prior to the measurement of any sample suspected to be corrosive.

  Care should be taken with gas mixtures containing potentially condensable components in addition to water vapor, e.g. oil, to insure that only water vapor is present in the sample. Once present on the surface of the sensors, oil will remain, and reduce the sensitivity of the sensor.

POSSIBLE INJURY! The tubing, valves and other apparatus attached to this instrument must be adequate for the maximum pressure which will be applied, otherwise physical injury to the operator or bystander is possible.

Before disconnecting the HygroPort I.S. from the gas line it is essential to vent the system to atmospheric pressure, otherwise severe injury could result.

7 CALIBRATION

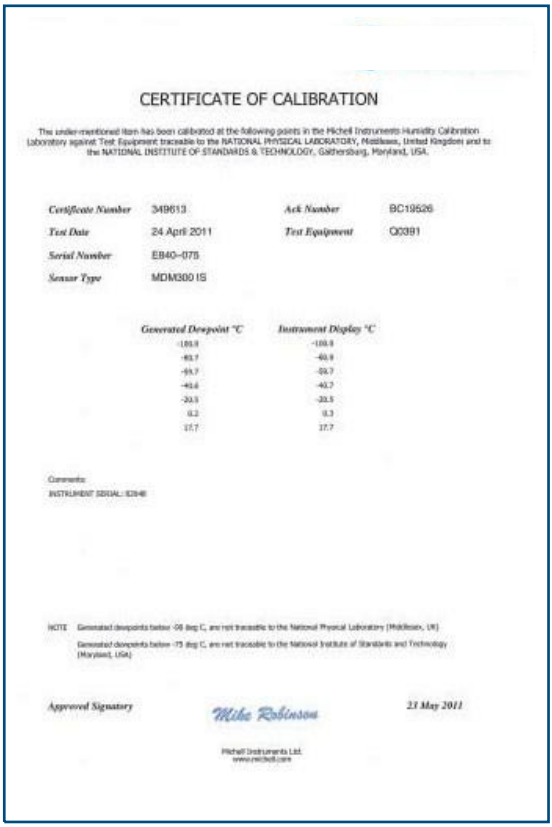
7.1 Traceability

The calibration of this instrument is traceable to national standards. For this reason the instrument should only be calibrated in an accredited e.g. NIST (U.S.) or UKAS (U.K.) standards laboratory.

If these facilities do not exist it is recommended that the instrument be returned to Kahn Instruments Inc. or one of its approved agents.

A calibration certificate bearing a seven point calibration is issued with each instrument.

Figure 7.1 shows a typical seven point calibration certificate.



CERTIFICATE OF CALIBRATION

The under-mentioned item has been calibrated at the following points in the Michell Instruments Humidity Calibration Laboratory against Test Equipment traceable to the NATIONAL PHYSICAL LABORATORY, Middlesex, United Kingdom and to the NATIONAL INSTITUTE OF STANDARDS & TECHNOLOGY, Gaithersburg, Maryland, USA.

Certificate Number	348613	*Ack Number*	BC19526
Test Date	24 April 2011	*Test Equipment*	Q0391
Serial Number	EB40–075		
Sensor Type	MDM300 IS		

Generated Dewpoint °C	*Instrument Display °C*
-109.8	-109.8
-80.7	-80.8
-59.7	-59.7
-40.6	-40.7
-20.5	-20.5
0.2	0.3
17.7	17.7

Comments:
INSTRUMENT SERIAL: 82648

NOTE Generated dewpoints below -08 deg C, are not traceable to the National Physical Laboratory (Middlesex, UK)
Generated dewpoints below -75 deg C, are not traceable to the National Institute of Standards and Technology (Maryland, USA)

Approved Signatory Mike Robinson *23 May 2011*

Michell Instruments Ltd.
www.michell.com

Figure 7.1 Typical 7-point calibration certificate

7.2 Calibration Method

WARNING:
These procedures require the use of specialized test equipment and calibration adjustments should only be carried out by qualified personnel. If not correctly carried out, the instrument's calibration can be lost.

The calibration procedure for the instrument is as follows:

1. Turn on the instrument, allow the initialization period to complete and allow sufficient time for it to stabilize.
2. Insure the instrument is set up with sample gas as **AIR** and operating pressure as **ATMOS**.
3. Insure that the temperature units are set up as **°C** and the primary display is reading **Dewpoint**.
4. Insure that all sample tubing and connectors are made from stainless steel and are of suitable quality. Remove the sintered filter from the inlet of the HygroPort I.S.
5. Connect the HygroPort I.S. to a dewpoint generator and establish a gas flow through the instrument.
6. Apply a dewpoint of -100°C and allow the instrument's reading to stabilize for a minimum of 96 hours (including dry down). **Measurement OK** must be displayed in the status line when readings are taken.
7. Record the applied REF dewpoint and the corresponding HygroPort I.S. display reading.
8. Repeat steps 5 and 6 at all the required dewpoint values over the operating range of the instrument, as shown in Table 6.1, allowing the stabilization times shown before recording consecutive readings.

A set of results similar, for example, to that shown in Table 6.1 could be generated over the calibration range of the instrument.

DP REF °C	Stabilize Time (Hours)	HygroPort I.S. Rdg °C	DP REF °C	Stabilize Time (Hours)	HygroPort I.S. Rdg °C
-100	96	-99.8	-30	1	-30.1
-80	12	-79.7	-20	1	-19.9
-70	8	-70	-10	1	-10
-60	4	-59.8	0	1	0.1
-50	2	-49.8	10	1	10
-40	1	-39.9	20	1	20

Table 7.1 Example of calibration run readings

7.3 Calibration Correction Method

To enter the Calibration Menu screen, highlight **CALIBRATION** from the Main Menu by using a combination of the scroll up and scroll down keys and press the Enter key.

NOTE: Any logging procedure currently in operation must be cancelled before the calibration procedures can be entered.

Entry to the Calibration Menu is protected by a PIN which must first be entered. The PIN (**4876**) is entered in a similar manner to that described in Section 2.5.

This gives access to the HygroPort I.S. calibration look-up table as shown in Figure 7.2 and provides the facility to select and change any single or number of points by means of the scroll up, scroll down, scroll right and scroll left keys.

Figure 7.2 HygroPort I.S. calibration correction screen

The look-up table is divided into three columns. The values in the first column **POINT** represent the thirteen nominal calibration points, spread at 10°C intervals over the instruments operating range of -100 to +20°C (-148 to +68°F). These points cannot be edited.

The second column of the table represents the value of the reference (**REF**) dewpoint standard applied at that particular point and the value in the column immediately to the right represents the reading that the HygroPort I.S. was showing at the corresponding **REF** level input.

The values in both the **REF** and **HygroPort I.S.** values can be edited by means of the scroll up and scroll down keys. The scroll right and scroll left keys provide the means of switching between corresponding table columns.

To edit a set of look-up table values, proceed as follows (Figure 7.3 shows the key sequence):

1. Initially, upon entering the look-up table, the **REF** column is highlighted. From the calibration run (see Table 6.1) enter the exact value of the **REF** dewpoint supplied to the instrument **(100.1**) by using the scroll up and scroll down keys.
2. To change a single point only: use the scroll right key (press 5 times) to highlight the corresponding HygroPort I.S. row entry and use the scroll up and scroll down keys to edit this value to the value recorded during the calibration run (**99.8**). **Alternatively, if all values are to be edited, enter all five REF points and then enter all the corresponding HygroPort I.S. points.**
3. Repeat steps 1 and 2 above for all the table entries that need to be made.
4. After the last entry has been made, press the Enter key.
5. To accept the changes press the scroll right key or, to return to the Calibration Menu screen without making any changes, press the scroll left key.

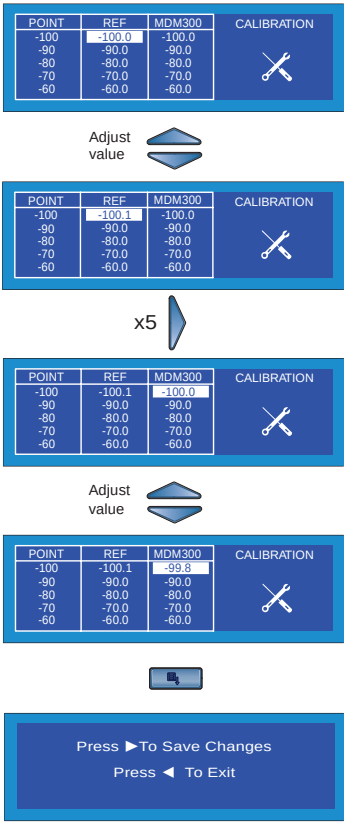


Figure 7.3 Edit HygroPort I.S. look-up table

8 PREPARATION FOR SHIPPING

For shipping purposes the instrument should be packed into its original carton, the latter providing the recommended degree of protection during transit.

To prepare the instrument for shipping, proceed as follows:

1. Turn the instrument off and remove any connections to the Gas In and Gas Out ports and any external transmitters connected to it.
2. If installed, remove the instrument from its carrying case.
3. Pack the instrument in its original case (1) as shown in Figure 8.1.
   NOTE: Any accessories should be packed in the box (4). Unless returning them for repair, it is not necessary to return any external transmitters or the battery charger.
4. Create a packing list detailing all equipment contained in the box, place it inside the box and seal the box.

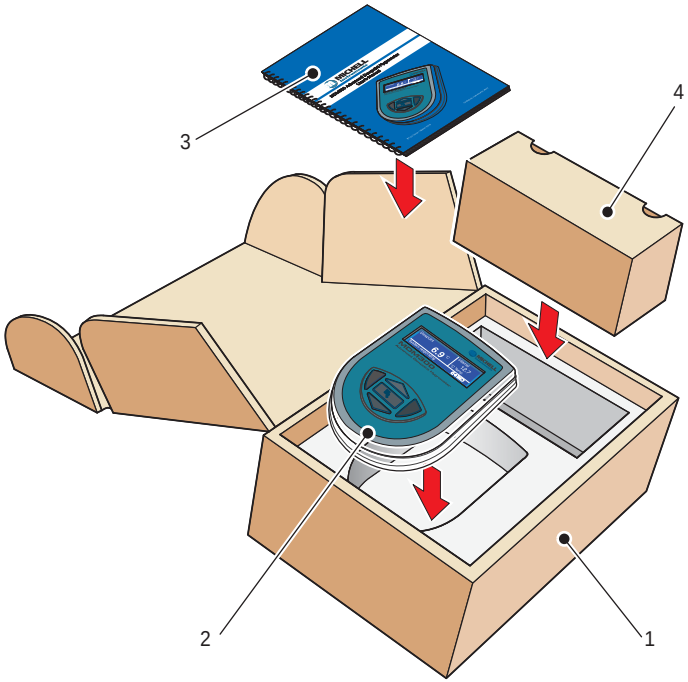


Figure 8.1 Instrument packing details

Appendix A

Technical Specifications

Appendix A Technical Specifications

Performance	
Measurement Technology	Kahn ceramic sensor
Accuracy	±1ºC from -60 to +20ºCdp (-76 to +68ºFdp) ±2ºC from -100 to -60ºCdp (-148 to -76ºFdp) ±0.2ºC (0.3ºF) temperature
Measurement Range	Calibrated -100 to +20ºCdp (-148 to +68ºFdp) Readings to +30ºCdp (+86ºFdp)
Measurement Units	°C, °F, K dewpoint & gas temperature ppm_W & g/kg for air, N_2, H_2, CO_2, SF_6 ppm_V, lb/MMscf & g/m^3 for natural gas ppm_V, g/m^3 & %RH
Resolution (display)	0.1 for all dewpoint derived units and auto ranging where appropriate
Resolution (measurement)	Better than 0.1ºCdp (0.2ºFdp)
Typical Response Speed	T95 in ≤30 minutes to -76ºF (-60ºC)
Electrical Output/Input	
Auxiliary Inputs	Connection to Kahn Easidew I.S. or Kahn Easidew PRO I.S. via Remote Sensor Interface
Battery Operating Life	More than 24 hours of typical usage between charges
Battery Charger	Intelligent charger. Charger not certified for hazardous area use
Operating Conditions	
Operating Pressure	0-5000 psig / 350 bar max
Operating Environment	Outdoors 0 to +100% RH condensing
Operating Temperature	-4 to +122ºF (-20 to +50ºC)
Storage / Transport Temperature	-40 to +158ºF (-40 to +70ºC)

Mechanical Specifications	
Display	Blue LCD graphical display
Enclosure Type	Steel fiber-loaded high-impact polyamide 6
IP/NEMA Rating	NEMA4 /IP66
Gas Connections	1/8" NPT female (other options available)
Flow Across Sensor	0.4 and 1.0 scfh (0.2 to 0.5 Nl/min)
Filters	50 micron stainless steel sinter in the inlet port
Gas Wetted Materials	AISI 316L stainless steel, PTFE Seal, Borosilicate glass, ceramic
Outline Dimensions	8.6 x 6.7 x 3.5" (218 x 170 x 90mm) (d x w x h)
Weight	3.3 lbs (1.5 kg)
Data Logging	8 megabytes; Log interval: 5 to 60 sec Logs per log file: Up to 10,000
Communications	(Wireless) Bluetooth™ range up to 5m (16ft) (Version 2.0)
Languages	English, French, German, Italian, Portuguese, Spanish
Hazardous Area Certificates	ATEX & IECEx – EX Group II Cat 1G Ex ia IIC T4 Ga -20ºC to +50ºC FM – NEC 500 Class I Division 1 Groups A,B,C,D T4 CSA – IS Class I, Division 1, Groups A, B, C, D T4

Appendix B

Hazardous Area Certification

Appendix B Hazardous Area Certification

HygroPort I.S is certified compliant to the ATEX Directive (94/9/EC), and IECEx for safe use within a hazardous area and has been assessed so by Baseefa 2001 Ltd (Notified Body 1180).

This product conforms to the Standards:

EN60079-0:2009
EN60079-26:2007
IEC60079-11:2006
FM CLASS 3600:1998
FM CLASS 3810:2005
CAN/CSA-C22.2 No.0-M91(R2006)
C22.2 No.142-M1987(R2004)

EN60079-11:2007
IEC60079-0:2007-10
IEC60079-26:2006
FM CLASS 3610:2010
ANSI/IEC 60529:2004
CAN/CSA-C22.2 No. 157-92(R2006)

and is attributed with the product certification code:

II 1 G Ex ia IIC T4 Ga (–20ºC to +50ºC)
Intrinsically Safe Class 1, Division 1, Groups A, B, C or D T4

ATEX Certificate Number : BASEEFA09ATEX0149
IEC Certificate Number: BAS09.0063
FM Certificate Number: 3036712
CSA Certificate Number: 2318983

Input Terminal Parameters

Charging Socket	
U_m	= 18V
External Sensor Socket	
U_i	= 28V
I_i	= 93mA
P_i	= 0.65W
PO	= 0
C_i	= 0
L_i	= 0

Special Conditions of Use

None

A.1 Baseefa Certificate

Certificate Number
Baseefa09ATEX0149

Issued 16 April 2010
Page 1 of 2

1 **EC - TYPE EXAMINATION CERTIFICATE**

2 **Equipment or Protective System Intended for use in Potentially Explosive Atmospheres Directive 94/9/EC**

3 EC - Type Examination Certificate Number: **Baseefa09ATEX0149**

4 Equipment or Protective System: **MDM300 I.S. Portable Dewpointmeter**

5 Manufacturer: **Michell Instruments Ltd,**

6 Address: **Ely, Cambridgeshire, CB6 3NW**

7 This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Baseefa, Notified Body number 1180, in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential Report Nos.

GB/BAS/ExTR09.0089/00 and GB/BAS/ExTR09.0128

9 Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2009 EN 60079-11:2007 EN 60079-26:2007

except in respect of those requirements listed at item 18 of the Schedule.

10 If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC - TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protective system. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

12 The marking of the equipment or protective system shall include the following :

Ex II 1 G Ex ia IIC T4 Ga (-20°C to +50°C)

This certificate may only be reproduced in its entirety, without any change, schedule included.

Baseefa Customer Reference No. **4014** Project File No. **08/0244**

This certificate is granted subject to the general terms and conditions of Baseefa. It does not necessarily indicate that the equipment may be used in particular industries or circumstances.

R S SINCLAIR
DIRECTOR
On behalf of
Baseefa

Baseefa
Rockhead Business Park, Staden Lane,
Buxton, Derbyshire SK17 9RZ
Telephone +44 (0) 1298 766600 Fax +44 (0) 1298 766601
e-mail info@baseefa.com web site www.baseefa.com
Baseefa is a trading name of Baseefa Ltd
Registered in England No. 4305578. Registered address as above.

Certificate Number
Baseefa09ATEX0149

Baseefa

Issued 16 April 2010
Page 2 of 2

13 **Schedule**

14 **Certificate Number Baseefa09ATEX0149**

15 Description of Equipment or Protective System

The MDM300 is a portable dewpointmeter. It comprises electronic circuitry powered by a rechargeable battery pack, a front panel LCD, custom rubber keypad and a humidity sensor that is connected to using rear panel pipe connections.

The MDM300 also accepts signals from an external 4-20mA dewpoint sensor that connects via a connector on the rear panel.

The terminal parameters for the equipment are:

Charging Socket

U_{in} = 18V
The MDM300 is designed to be charged from a charger with an output of no greater than 18V d.c.

External Sensor Socket

U_i = 28V
I_i = 93mA
P_i = 650mW
P_o = 0
C_i = 0
L_i = 0
The external Sensor Socket is designed to connect to an externally powered 4-20mA loop.

16 Report Number

GB/BAS/ExTR09.0089/00

17 Special Conditions for Safe Use

None

18 Essential Health and Safety Requirements

All relevant Essential Health and Safety Requirements are covered by the standards listed at item 9.

19 Drawings and Documents

Number	Sheet	Issue	Date	Description
Ex80701/PL	1 to 4	02	24/03/10	MDM300IS Main PCB Assembly
Ex80703/PL	1	01	20/01/10	MDM300 I.S. Heater Interface PCB
Ex80746/PL	1	01	20/01/10	MDM300IS Battery Pack PCB Assembly
Ex80796/PL	1	01	03/02/10	MDM300IS Sensor PCB Assembly
Ex90412	1 to 25	02	24/03/10	MDM300 I.S. ATEX & IECEx Certification Drawing

A.2 ICEx Certificate of Conformity

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx BAS 09.0063 issue No.:0 Certificate history:

Status: Current

Date of Issue: 2010-04-16 Page 1 of 3

Applicant: Michell Instruments Limited
Unit 48
Lancaster Way Business Park
Ely
Cambridge
CB6 3NW
United Kingdom

Electrical Apparatus: MDM300 I.S. Portable Dewpointmeter
Optional accessory:

Type of Protection: Intrinsic Safety

Marking: Ex ia IIC T4 Ga (-20°C to +50°C)

Approved for issue on behalf of the IECEx Certification Body: R S Sinclair

Position: Managing Director

Signature: (for printed version)

Date: 19-4-10

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:
Baseefa
Rockhead Business Park
Staden Lane
Buxton
Derbyshire
SK17 9RZ
United Kingdom

Baseefa

IECEx Certificate of Conformity

Certificate No.: IECEx BAS 09.0063

Date of Issue: **2010-04-16** Issue No.: **0**

Page 2 of 3

Manufacturer: **Michell Instruments Limited**
Unit 48
Lancaster Way Business Park
Ely
Cambridge
CB6 3NW
United Kingdom

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2007-10 Edition: 5	Explosive atmospheres - Part 0:Equipment - General requirements
IEC 60079-11 : 2006 Edition: 5	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
IEC 60079-26 : 2006 Edition: 2	Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

GB/BAS/ExTR09.0089/00
GB/BAS/ExTR09.0128/00

Quality Assessment Report:
GB/BAS/QAR07.0018/02

IECEx Certificate of Conformity

Certificate No.: IECEx BAS 09.0063

Date of Issue: **2010-04-16** Issue No.: **0**

Page 3 of 3

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The MDM300 is a portable dewpointmeter. It comprises electronic circuitry powered by a rechargeable battery pack, a front panel LCD, custom rubber keypad and a humidity sensor that is connected to using rear panel pipe connections.

The MDM300 also accepts signals from an external 4-20mA dewpoint sensor that connects via a connector on the rear panel.

Terminal parameters are shown in the certificate annex.

CONDITIONS OF CERTIFICATION: NO

Annexe: IECEx BAS 09.0063-Annex.pdf

Baseefa Rockhead Business Park Staden lane, Buxton, Derbyshire SK17 9RZ United Kingdom	Baseefa

ANNEX to IECEx BAS 09.0063 Issue No. 0 Date: 2010/04/16

The terminal parameters for the equipment are:

Charging Socket

U_m = 18V

The MDM300 is designed to be charged from a charger with an output of no greater than 18V d.c.

External Sensor Socket

U_i = 28V
I_i = 93mA
P_i = 650mW
P_o = 0
C_i = 0
L_i = 0

The external Sensor Socket is designed to connect to an externally powered 4-20mA loop.

A.3 FM Approvals Certificate of Compliance

FM Approvals
1151 Boston Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: 781 762 4300 F: 781-762-9375 www.fmapprovals.com

CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

MDM300 I.S. Portable Dewpoint Meter
IS / I / 1 / ABCD / T4 Ta = 50°C; IP66 – Ex90467.

Equipment Ratings:

Intrinsically safe for Class I, Division 1 Groups A, B, C and D.

FM Approved for:

Michell Instruments Limited
Ely, Cambridgeshire CB6 3NW, United Kingdom

3036712
Page 1 of 2

FM Approvals
Member of the FM Global Group

This certifies that the equipment described has been found to comply with the following Approval Standards and other documents:

Class 3600	1998
Class 3610	2010
Class 3810	2005
ANSI/IEC 60529	2004

Original Project ID: 3036712 Approval Granted: July 15, 2010

Subsequent Revision Reports / Date Approval Amended

Report Number	Date	Report Number	Date

FM Approvals LLC

J. E. Marquedant
Group Manager, Electrical

15 July 2010
Date

3036712
Page 2 of 2

A.4 CSA Certifcate of Compliance

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 2318983 Master Contract: 190597

Project: 2318983 Date Issued: September 21, 2010

Issued to: Michell Instruments Limited
Lancaster Way Business Pk, Unit 48, Ely
Cambridgeshire, CB6 3NW
UNITED KINGDOM

Attention: Ian Arnold

The products listed below are eligible to bear the CSA Mark shown

Eric Giusti
Issued by: Eric Giusti

PRODUCTS

Class 2258-04 PROCESS CONTROL EQUIPMENT - Intrinsically Safe, Entity - For Hazardous Locations

IS Class I, Division 1 Groups A, B, C and D T4

Portable Intrinsically Safe Dewpoint Transmitter Model MDM300 I.S., Temperature code T4; Maximum Ambient +50°C.The transmitter is battery powered. Control drawing Ex 90468.
It accepts also signals from an external 4 … 20mA dewpoint sensor that connects via connector on the rear panel.

Charging socket: 18V (charger output : 18VDC max.)
External sensor socket (4 … 20mA loop connection): Vmax = 28 V, Imax = 93 mA, Pmax = 651 mW, Ci = 37 nF, Li = 0 µH.

APPLICABLE REQUIREMENTS

CAN/CSA-C22.2 No. 0-M91(R2006)	- General Requirements Canadian Electrical Code, Part II
CAN/CSA-C22.2 No. 157-92 (R2006)	- Intrinsically Safe and Non-incendive Equipment for use in Hazardous Locations.
C22.2 No. 142-M1987 (R2004)	- Process Control Equipment.

DOD 507 Rev. 2009-09-01

Certificate: 2318983 CSA INTERNATIONAL Master Contract: 190597
Project: 2318983 Date Issued: September 21, 2010

MARKINGS

(1) Submittor's name, trademark
(2) Catalogue / Model designation.
(3) Entity Parameters
(4) Date code / Serial number traceable to month and year of manufacture.
(5) The CSA Monogram
(6) Maximum ambient temperature Ta = + 50 °C
(7) Reference to control drawings Ex90468
(8) The words "IS Class I, Division 1, Groups A, B, C and D T4"

METHOD OF MARKING:

The permanent markings appear on an self-adhesive metalised polyester manufactured by 3M (CUL MH18072) and is mounted on the surface of the apparatus.

DOD 507 Rev. 2009-09-01 Page 2

Appendix C

Datalog Status Display

Appendix C Datalog Status Display

Introduction

When the status of the current log file is displayed, see Figure C.1, the **ST** column in the current log file display represents the instrument's status at the time that each log point is recorded.

#	INT	EXT	ST
106	26.8	100.0	0028
107	26.2	-90.0	0028
108	25.9	-80.0	0028
109	25.8	-70.0	0028
110	25.5	-60.0	0028

File	CR270309
INT	RH
EXT.	EXT_DP
INTVAL	05 Sec
D#	090327
T#	123606

Figure C.1 Current datalog file display

This column shows a hexadecimal representation of the instrument's 16-bit status register shown below in Figure C.2. Bit 1 is the least significant bit. The four most significant bits, Bits 13 to 16 are for Kahn Instruments' service use and so the first character in any HygroPort I.S. ST display will always read 0.

Status register Bit position															
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
N/A	N/A	N/A	N/A	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	N/A

Figure C.2 HygroPort I.S. status register

For the example given for each of the log plots shown on in Figure C.1 (Hex 0028), the output pattern of the status register will be as shown in Figure C.3.

Status register Bit position															
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
N/A	N/A	N/A	N/A	0	0	0	0	0	0	**1**	0	**1**	0	0	N/A

Figure C.3 HygroPort I.S. status register (Hex 28)

Each of the error bits set high (1) represents a specific status or error condition. In this example, Bits 4 and 6 are set high indicating that two (status) conditions exist.

Table C.1 shows the status flags associated with each Bit of the status register. If a status flag is set high then the associated condition exists. If it is set low, then that condition does not exist.

Status Register Bit in Hex	Message	Details
0x0002 = BIT 2	**Internal sensor error**	Reading out of range (beyond +30/-120ºC)
0x0004= BIT 3	**Internal thermistor error**	Reading out of range (beyond +100/-40ºC)
0x0008 = BIT 4	**External sensor error**	External Sensor Input out of range (<4 mA / >20 mA)
0x0010 = BIT 5	**Battery low**	Battery voltage <4.7 V
0x0020 = BIT 6	**Measurement in progress**	Internal dewpoint not stable
0x0040 = BIT 7	**Measurement OK**	Internal dewpoint stable
0x0080 = BIT 8	**Log finished**	Log file has reached the maximum of 10,000 logs and logging has been stopped
0x0100 = BIT 9	**Internal sensor not found**	Could not detect internal sensor on power up
0x0200 = BIT 10	**Default CONFIG file used**	Config. file missing, new file created and default settings used
0x0400 = BIT 11	**Flow rate too high**	Flow rate is higher than specified maximum
0x0800 = BIT 12	**Initializing internal sensor**	Indicates system in purging phase

Table C.1 Status register flags

For the example given in Figure C.1, from Table C.1, Hex 28 translates, reading from right to left, as Bit 4 set (**External sensor error**) and Bit 6 set (**Measurement in progress**). Therefore, at the time that these log points were taken, the external sensor was out of range and the internal dewpoint was not stable.

Appendix D: EC Declaration Of Conformity

EC Declaration of Conformity.

Manufacturer:	Michell Instruments Limited
Address:	48 Lancaster Way Business Park Ely, Cambridgeshire CB6 3NW. UK.
Equipment Type:	**MDM300 I.S. Advanced Dewpoint Hygrometer**

CE

Directive 94/9/EC ATEX

Provisions of the Directive fulfilled by the Equipment:	**Group II Category 1G Ex ia IIC T4 Ga (-20°C to +50°C)**
Notified Body for EC-Type Examination and Production (QAN):	**Baseefa, Buxton. UK. Notified Body No. 1180**
EC-Type Examination Certificate:	**Baseefa09ATEX0149**
Standards used:	**EN 60079-0:2009 EN60079-11:2007 EN60079-26:2007**

IECEx Certification:

Certificate of Conformity No.	**IECEx BAS 09.0063**
Marking.	**Ex ia IIC T4 Ga (-20°C to +50°C)**
Standards used:	**IEC60079-0:2007-10 IEC60079-11:2006 IEC60079-26:2006**
Type of Protection.	**Intrinsic Safety**

Other Directives

2004/108/EC EMC Directive

1999/5/EC R&TTE (Radio Equipment and Telecommunications Terminal Equipment) Directive.

Article 3.1a	As part of EN61010-1:2001
Article 3.1b	EN 301 489-1 V1.8.1 (2008-04), EN 301 489-17: V1.2.1 (2002-08) Electromagnetic Compatibility and radio spectrum Matters (ERM);Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 17:Specific conditions for wideband data HiperLAN equipment
Article 3.2	EN 300 328 V1.5.1 (2004 – 08), Radio Equipment and Systems (RES); Wideband transmission systems; Technical characteristics and test conditions for data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques. Part 2: Harmonized EN covering essential requirements under article 3 (2) of the R&TTE directive.

And conformance with Standards:

EN61326-1:2006	Electrical equipment for measurement, control and laboratory use – EMC requirements 1. Class B & Industrial locations immunity.
EN60529	Degrees of Protection Provided by Enclosures. Ingress Rating equivalent to IP66

We declare under our sole responsibility that this product complies with all the essential requirements of the EC Directives listed and has been designed and tested to be in conformance with the relevant sections of the standards or other normative documents listed.

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Andrew M.V. Stokes, Technical Director
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